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A Critical Study of the Factors Determining Effective Strength Tests for Women

By Aileen Carpenter

Southern Illinois State Teachers College
Carbondale, Illinois

INTRODUCTION

RECENT emphasis on strength testing in the literature of physical education makes desirable a re-study of the tests themselves and of the part they play in the whole scheme of testing and measuring. Early measurement dealt chiefly with body size and symmetry.[5]* About 1880 the interest began to shift from body size to muscular strength, the measurement of which was made possible by the invention of the dynamometer. Sargent, one of the earliest investigators, devised an "Intercollegiate Strength Test" which included back and leg lifts, right and left grips, chins and dips,† and lung pressure. Lung capacity was later substituted for lung pressure.[39] Kellogg's interest in exercise chiefly as a therapeutic measure led to the invention in 1896 of the Universal Dynamometer by which the strengths of a large number of muscle groups can be measured.[5] Unfortunately this dynamometer is a stationary piece of apparatus, cannot be moved about freely, and priced beyond the resources of most high schools and small colleges.[6]

Considerably later, about 1915, Martin's interest in the after effects of infantile paralysis led him to develop the "resistance type strength tests" through the use of which the strengths of a large number of muscle groups can be conveniently tested using an inexpensive and easily portable dynamometer.[30] He devised tests applicable to eleven muscle groups inserted in each arm and ten inserted in each leg. Each of the series was correlated with the total score of the whole set. Ten pairs correlated .80 or better. Since abbreviated batteries are desirable, five tests were selected from the ten on the basis of relative ease in testing and general suitableness: thigh adductions, thigh abductors, pectorals, forearm and wrist flexors. The latter two were omitted by Martin and Rich in all studies except those on industrial workers. Martin and Rich suggest the use of the ratio of strength to weight as a better criterion of motor ability than strength itself. They found no relation between strength and height. Their emphasis is chiefly upon the industrial applications of their tests.

* Indices refer to Bibliography at end of article.

† The terms "chin" and "dip" which are very common in the literature will be used throughout this study in the place of pull-up and push-up which are sometimes used.

Within the next ten years, about 1925, Rogers began his campaign in the interest of strength testing.[5] Following the lead of the intercollegiate strength test, he developed a "Strength Index" which includes back and leg lifts, right and left grips, lung capacity, and chinning and dipping scored according to a formula which he devised.[35] From the strength index the "Physical Fitness Index" can be computed by multiplying the strength index by 100 and dividing it by the norm for the individual's sex, age, and weight.

Coincident with the fairly wide use of strength indices, various investigators have studied the individual items included. Speaking of the substitution of lung capacity for lung pressure in the intercollegiate type test, Seaver says, "The intent of this test originally was to discover the power of the expiratory muscles, but difficulty was found in eliminating the influence of the buccal muscles that are much stronger than the expiratory group." [39] He deplores the substitution of lung capacity which does not measure lung pressure saying, "This test should be dropped from the records altogether, for by so doing the scientific value of the data is improved and the value of past records in comparison is not impaired."[39] This contention of Seaver's that lung capacity adds practically nothing to the value of a battery of strength tests has been further confirmed by McCloy[16] and Van Dalen.[41]

Van Dalen, in a study the purpose of which was "to determine whether or not there is any relationship between the physical fitness index and the breathing capacity index of prepubescent and postpubescent boys," used the physical fitness index records of 238 twelve-year-old boys and 229 seventeen-year-old boys.[41] Those weighing 20 per cent over or under the average according to Baldwin-Wood tables were omitted. The chinning and dipping strengths were scored according to McCloy's formula[23] and the physical fitness index scores were computed on McCloy's norms.[24] The Breathing Capacity Index was computed by multiplying the lung capacity by 100, then dividing it by the norm for age, height, and weight using Kelly's norms.[13] Correlations computed gave the following results:

P. F. I.—B. C. I. of prepubescent boys	.202
P. F. I.—B. C. I. of postpubescent boys	.221

Van Dalen concludes, "The results of this study would seem to indicate that lung capacity is of little significance as an element in the strength test. Its addition makes no notable increase in the validity of the strength test itself, and so it may as well be omitted from this battery."[41]

McCloy reports a study in which the modified Rogers' physical fitness index, with chinning and dipping scored according to McCloy's formula and with lung capacity omitted, correlated .7193 with the criterion, a battery of motor ability tests.[16] The same battery with

lung capacity included correlated .7224 with the same battery of motor ability tests. Obviously lung capacity is of very little additional value.

McCloy, in his studies on chinning and dipping, points out that the Rogers' formula for scoring these events gives the individual who did just one chin credit for one tenth of his weight while the individual who chins thirty times gets credit for three times his weight.[23] This is obviously an unfair arrangement. In a study of 420 Detroit elementary school boys the intercorrelations of chinning, age, height, and weight showed that height and weight have practically no relationship to chinning so far as *numbers* of chins are concerned. The correlation of chinning with track and field scores was .3986. In another study 33 Detroit boys chinned as many times as possible each of the first two days, then on each succeeding day they did the same but with five pounds of weight added each day until not one chin could be accomplished. From the ratios computed and the correlations made, this conclusion was drawn: "Additional weights reduced the chinning ability an equal amount for each equal increase in weight." From multiple regression equations several formulae were derived for scoring chinning strength. Using another method of determining chinning strength on 77 New York men, several formulae for scoring were computed but none correlated as highly with strength as those developed in the previous experiment. Using this weighting, chinning and dipping correlated with track and field .7512. From these studies McCloy concludes, "Chinning and dipping, or chinning alone, scored in this way, can be used as a classifying device which seems to be as adequate on the whole as the total strength test."[23]

Later, McCloy reports several studies concerning the importance of arm strength in athletics.[16] The strength tests used are back and leg lifts, grips, and chinning and dipping scored according to his formula. In two of the studies a battery of tests for motor ability including track and field scores, strength by throwing a medicine ball for distance, agility by obstacle races, and so forth, was used as the criterion. In three studies the criterion was track and field records scored on a mathematically devised scoring table. In one case power as measured by the Sargent jump was the criterion, in one the football rating by three coaches, and in one the subjective classification of the gymnasium instructor. The complete battery of strength tests and each of the separate strength tests themselves were correlated with the different criteria. In correlating power relative to weight, as developed in the Sargent jump, with each of the strength tests he found that arm strength gives almost as high a correlation (.808) as does total strength (.828). From this evidence he concludes, "Arm strength is the most important strength element in the jump." In the study using football ratings he found that back and leg strengths were most important. From these and

other results he concludes, "In all cases except football, back and leg strength seemed to be of relatively little importance for predicting either motor ability, track and field ability, or for classification." In one study, Martin's thigh flexor test was used and shown to be of greater value in predicting general motor ability than back and leg strength. Apparently, however, "Arm strength is the most important strength factor in the prediction of either general motor ability or track and field ability for boys."

Working in conjunction on 65 students selected at random from Cornell University, Smiley rated each from a medical point of view and Chamberlin scored each according to the physical fitness index, computed by Rogers' method.[7] Of the 65 cases, 52 agreed—an 80 per cent agreement. They conclude, "It would appear from the results of this study that the physical fitness index is sufficiently objective to be of excellent advantage to physical educators as a rough measure of physical fitness for big-muscle activities, but that its use should, however, be restricted to the classification of pupils for big-muscle activities, and that it should not be substituted for the physical examination."[7]

In her study entitled "Weighted Strength Tests for the Prediction of Athletic Ability in High School Girls," Anderson reports the use of the Rogers' strength test with lung capacity omitted, thigh flexors measured by the Martin technique added, and chinning and dipping scored by the McCloy formula for girls.[8] Her athletic ability score included the forty-yard dash, the standing broad jump, the running high jump, and the basketball throw for distance all scored according to McCloy's scoring tables. Using data from 300 high school girls, she computed zero order, partial, and multiple correlations, and multiple regression equations. From a variety of batteries she found a short one which correlates .527 with track and field athletics, almost as high as the entire strength battery correlates with the criterion. It is: 5 (thigh flexors) + 7 (dips) + 1 (leg lift). Another fairly good battery is made by adding 5 (grips) to the above equation. In another study she found that track and field may be predicted by the following equation: 5 (thigh flexors) + 7 (push) + 1 (leg lift). The multiple correlation of track and field with the longest battery tried was .55. From her studies Anderson observes that strength is not the sole factor in girls' athletic ability, speed and build may enter, girls may be less willing to give their uttermost in strength tests, and relative differences in skills in track and field may have contributed. She concludes that "neither total strength nor the physical fitness index is a very valid predictor of athletic ability of the girls tested."[8]

In another study on the same data with the Sargent jump added, Anderson correlated the unweighted strength index, weighted strength

index, unweighted physical fitness index, weighted physical fitness index, and the Sargent jump with subjective ratings of the students by their teacher.[2] She found the Sargent jump to be by far the best. Health ratings made by the girl and the instructor when correlated with the individual strength tests gave correlations of .2 or below. Two types of endurance ratings were devised and correlated with the strength tests, they gave correlations which, although not very high, were positive. Anderson concludes, "Strength tests for girls seem to give lower correlations with similar criteria than is true with boys."

Wendler, in his study entitled, "An Analytical Study of Strength Tests Using the Universal Dynamometer" studied 47 different muscle groups on 474 men and women tested with the Universal Dynamometer.[44] The sum of all these tests, total strength, is used as the criterion for the study. Of the 47 tests, 21 were selected for analysis on the basis of importance in physical activity. For each sex each measure was intercorrelated and multiple regressions were computed to find the best combinations. For these combinations, items which gave a high correlation with the criterion and a low correlaton with each other were generally selected. A combination closely approximating the major muscle groups tested by the intercollegiate strength test was included for comparison. Kinesiological analysis of testing procedures resulted in the selection of eight major muscle groups which are included in this battery. Evidence in their favor was sufficient to warrant the addition of thigh flexors to the group which is made up of the following: pectoralis major, thigh extensors, leg extensors, hand flexors, posterior trunk, latissimus dorsi, arm flexors, arm extensors, and thigh flexors. In the men's tests, the pectorals, thigh extensors, and leg extensors predominated. These three combined gave a corelation of .930 with total strength. For women, the thigh extensors were most valuable when the thigh flexors were omitted. The addition of the flexors raised the correlation but the extensors were no longer the most valuable. Of the remaining groups, all but those of arm strength were of about equal predictive value. Because the measurement of thigh extensors, foot extensors, and anterior trunk offer difficulties and require special apparatus, the following short battery is offered for use in the prediction of strength for men: (thigh flexors) + (leg extensors) + (arm flexors) + (pectoralis major). For women, the following battery is suggested: 7 (thigh flexors) + 5 (thigh extensors) + 3 (leg extensors) + 7 (pectoralis major) + 11 (deltoids) + 7 (hand flexors). The multiple correlation of this battery with total strength is .938.

This paucity of objective research in the field seems to indicate a need for further and more comprehensive studies of strength testing. The present study does not attempt to evaluate the place or importance of strength tests, but does attempt to study the elements that go to

make up good tests, and to analyze several practicable forms of such tests as they apply to the women's field.

REQUIREMENTS FOR SATISFACTORY TESTS

In order that a strength test be a satisfactory instrument, it must possess certain characteristics. The following list gives some of the essential qualifications for such a test:

1. The tests must not be too long nor take too much time to administer.
2. The tests must be valid, reliable, and objective.
3. The tests should be such that the administrator and teacher can use them to forward the aims and objectives of education.
4. The strength test or battery of tests must be an adequate and satisfactory measure of the total strength of the body.
5. In selecting tests to be used as representative of the total strength of the body, those tests should be chosen which show a high correlation with total strength but a relatively low intercorrelation with the other tests included.
6. In view of the importance of arm strength in physical educational activities, there should be included in the battery satisfactory measures of arm strength.
7. The activities involved in performing the tests should be related as closely as possible to natural types of activities so that the strength measured is truly indicative of the strength applicable to those activities.
8. The tests should use the muscle groups involved at relatively favorable angles in order that the scores may indicate the best work possible for those muscles.
9. The equipment for giving the tests should, if possible, be sufficiently inexpensive to enable the average school to purchase it.
10. The tests should be simple to score in order that the scores can be computed quickly and comprehended easily by the average individual.
11. The tests should be interesting to the participant in order to stimulate him to do his utmost, and to make the experience of being tested of educational value to him.

Anticipating the conclusions, the two batteries recommended, the intercollegiate with push and pull substituted for chinning and dipping and lung capacity omitted,(3)* the five Martin type tests with strength of grips added,(9) meet these requirements fairly well. The intercollegiate so modified would seem to be more interesting to the participant and to involve the use of strength in more natural activities. However, the equipment for the Martin type tests is less expensive and more readily movable. The intercollegiate battery has a set of validated norms. Al-

* Numbers in parentheses refer to batteries studied in the Appendix.

though the push and pull are not included, a substitute scoring can be used (see Table XIV in the Appendix) to meet this difficulty. The intercollegiate battery can be administered much more rapidly, and with less fatigue to the operator. This makes it the more practicable test.

SUBJECTS AND PROCEDURE

One hundred women students of Southern Illinois State Teachers College acted as subjects. An example of the data sheet used will be found in the Appendix. The data include for each of the one hundred subjects thirty anthropometric measurements,[15,17] Sargent jump, standing broad jump, sixty-yard dash, six-pound shot-put,[21,22] and twenty-eight strength tests.[30,34] The anthropometric measurements were taken according to standard anthropometric techniques.[15,17] The girths were taken by means of a steel tape. The bony measurements were taken by means of a metal sliding caliper. Chest width and circumference were taken at a xyphoid level. Hips were measured at the top of the ilium with pressure. The elbow and knee widths were taken with the calipers at the epicondyles of the humerus and femur, bisecting a ninety degree angle made by the subject's arm and leg. The fat measurements were taken by means of fat calipers which measure the thickness of the skin and subcutaneous layer of fat.[17,30]

The Sargent jump was taken as described in McCloy's directions.[21,22] The standing broad jump, six-pound shot-put, and sixty-yard dash were taken according to standard directions. The chin, dip, back lift, leg lift, left and right grips were administered according to Rogers' directions.[34] The chin and dip were scored according to McCloy's formula for girls:[23] dipping strength: 1.1 dips + .78 weight + 74; chinning strength: 1.2 chins + .67 weight + 52. These six strength scores were combined and used to compute the Physical Fitness Index. Since lung capacity has been found to be of little significance as an element in the strength test, it was omitted.[16,41] In a comparative study of scoring formulae for the chins and dips, they were rescored according to Rogers' formula: $(C+D)\ (W/10 + H - 60)$.[34]* Except for this small part in one of the studies, the McCloy formulae[23] for scoring chins and dips were used.

Push and pull were determined by having the subject hold her arms at shoulder level with elbows bent and hands grasping an attachment into which the hand dynamometer had been fitted. The apparatus was thus held firmly at mid-sternum level. For the push, the subject pushed inward on the handles with maximum force. For the pull, the subject pulled the handles as far apart as possible. In each case the reading was recorded from the dial of the dynamometer and the pointer pushed back to zero. The strength of the ten muscle groups were measured on

* Weight is in pounds and height in inches.

left and right sides by means of the technique described by Martin.[30] A combination of the scores for all[24] of the strength tests was designated as "Total Strength" (1). The intercollegiate (2) battery includes back and leg lifts, grips, chin and dip. The push-pull intercollegiate (3) consists of the intercollegiate battery with push and pull substituted for chinning and dipping. Still another combination included the intercollegiate with push and pull added. (4)

Two scores were recorded for all strength and athletic events. In cases where the correlations were corrected for attenuation,* mention is made of that fact. In all cases not otherwise designated, the better score in each test was used. The batteries, unless otherwise indicated, were composed of the better scores for each event included.

$$r\,x\,y = \sqrt{\frac{r x_1 y_2 \quad r x_2 y_1}{r x_1 y_2 \cdot r x_1 y_2}}$$

A Comparative Study of Intercollegiate Type Tests and Batteries

This phase of the study was undertaken to investigate the different test items which make up batteries of the intercollegiate type[5] to determine which battery and which relative weightings give the best predictions of total strength. Through the use of the Martin type tests[30] the muscle groups involved in several of these activities were studied in order to determine what relationship exists between ability in certain activities and the strengths of the chief muscle groups involved in those activities. The tests were conducted and scored as has been previously explained. Lung capacity was omitted.[15,41] This study is divided into three parts, a study of chinning strength, the pull, and the chief muscle groups involved; a study of dipping strength, the push, and the chief muscle groups involved; and a study of various combinations of these tests with grips, and back and leg lifts. Reports of these studies are given in the order listed.

CHINNING, THE PULL, AND CHIEF MUSCLE GROUPS INVOLVED

This study was undertaken in order to determine what relation there is between the ability to pull and to chin, and the strengths of the shoulder girdle muscles chiefly involved, and to determine which of these two measures is the better index of this type of shoulder girdle strength. The pulls were scored by pounds of pull achieved. The chins

* The accuracy of any series of test scores taken on different days, as these were, is conditioned by the number and size of the chance variations which may be due to slight changes in the technique or procedure of the experimenter or to fatigue or shifts of attention on the part of the subjects. Such errors tend to decrease or "attenuate" the coefficients of correlation. In order to correct the r's for such errors, the following formula was used:

The derivation of this formula will be found in the Appendix.

were scored according to McCloy's formula, which is: 1.2 C + .67 weight + 52.[23] Muscle strengths studied included the latissimus group, forearm flexors, and the posterior deltoids taken by the Martin technique for measuring muscle strength.[30] These five variables were intercorrelated. All of the correlations were corrected for attenuation. By way of comparison the chins were rescored by the Rogers formula, which is: (C) (W/10 + height − 60).[34] These correlations were also corrected for attenuation. The following table gives the results:

TABLE I

INTERCORRELATIONS OF CHINNING, PULL, AND CHIEF MUSCLE GROUPS INVOLVED

	McCloy Scoring	Rogers Scoring
Chins—self-correlation	.9149*	.7212
Pull—self-correlation	.7068	
Chins—pull	.5333	.3787
Pull—latissimus	.6114	
Chins—latissimus	.5277	.3700
Pull—posterior deltoids	.6174	
Chins—posterior deltoids	.5453	.3934
Pull—forearm flexors	.6071	
Chins—forearm flexors	.5440	.4184
Forearm flexors—posterior deltoids	.7799	
Forearm flexors—latissimus	.7200	
Posterior deltoids—latissimus	.7466	

* The high chinning self-correlation is largely spurious, due to the larger part which weight plays in the formula from which chinning strength is computed.

In each case, pull correlates more highly with the muscle strength than does chinning. The correlations with chinning strength computed by the Rogers' formula[34] are all notably lower than are those with chinning computed by the McCloy method. On this evidence it would seem safe to conclude that the McCloy method[23] is more indicative of the actual chinning strength. Consequently, for the remainder of this study, the chinning strength as computed by the McCloy formula[23] is used.

Partials* and multiples† were then computed, using the McCloy scored chins.

* "A coefficient of partial correlation may be said to represent the net relation between two variables when one or more other variables which might increase or decrease the true correlation have been ruled out or held constant."[9]

† "The multiple coefficient of correlation may also be thought of as giving the correlation between a trait (or traits) as measured by a single test, and the same trait (or traits) as measured by a number of tests taken together."[9]

TABLE II

PARTIAL CORRELATIONS OF CHINNING, PULL, AND CHIEF MUSCLE GROUPS INVOLVED

	Zero	Order r
Chins, flexor—pull	.3276	.5440
Pull, flexors—chins	.4466	.6071
Chins, posterior deltoids—pull	.3246	.5453
Pull, posterior deltoids—chins	.4606	.6174
Latissimus, chins—pull	.3021	.5277
Latissimus, pull—chins	.4593	.6114
Pull, flexors—posterior deltoids	.2661	.6071
Chins, flexors—posterior deltoids	.2360	.5440
Latissimus, flexors—pull	.5547	.7200
Latissimus, flexors—chins	.6074	.7200
Latissimus, posterior deltoids—pull	.5930	.7466
Latissimus, posterior deltoids—chins	.6443	.7466
Posterior deltoids, flexors—pull	.6482	.7799
Posterior deltoids, flexors—chins	.6872	.7799
Pull, posterior deltoids—latissimus	.3056	.6174
Chins, posterior deltoids—latissimus	.2677	.5453
Posterior deltoids, flexors—latissimus	.5248	.7799
Pull, flexors—latissimus	.1505	.6071
Pull, latissimus—flexors	.3160	.6114
Chins, flexors—latissimus	.2784	.5440
Pull, posterior deltoids—latissimus	.2677	.5453

In each case the pull takes more out, makes the partial r lower, than does the chinning and is apparently the more valid test for girls.

TABLE III

MULTIPLE CORRELATIONS OF CHINNING, PULL, AND CHIEF MUSCLE GROUPS INVOLVED

0 1 2		r 1-0	r 2-0
Pull—chins, flexors	.6533	.5333	.6071
Chins—pull, flexors	.6007	.5333	.5440
Pull—chins, posterior deltoids	.6600	.5333	.6174
Chins—pull, posterior deltoids	.5996	.5333	.5453
Pull—latissimus, chins	.7127	.6114	.5333
Chins—latissimus, pull	.5907	.5277	.5333
Pull—latissimus, flexors	.6570	.6114	.6071
Chins—latissimus, flexors	.5783	.5277	.5440
Pull—latissimus, posterior deltoids	.6575	.6114	.6174
Chins—latissimus, posterior deltoids	.5746	.5277	.5453
Pull—posterior deltoids, flexors	.6319	.6174	.6071
Chins—posterior deltoids, flexors	.5801	.5453	.5440
Posterior deltoids—pull, flexors	.8004	.6174	.7799
Posterior deltoids—chins, flexors	.7932	.5453	.7799
Latissimus—pull, posterior deltoids	.7607	.6114	.7466
Latissimus—chins, posterior deltoids	.7603	.5277	.7466
Latissimus—pull, flexors	.7527	.6114	.7200
Latissimus—chins, flexors	.7380	.5277	.7200
Pull—latissimus, flexors, posterior deltoids	.6576		
Chins—latissimus, flexors, posterior deltoids	.5909		
Chins (Rogers scoring)—latissimus, flexors, posterior deltoids	.4803		

Here again the pull shows itself to be superior to chinning.

The degree of relationship shown by the zero order correlations demonstrates that the five variables are interrelated rather closely. The muscle groups show notably higher correlations with each other than with the pull or chins. Of the latter two, the pull correlates consistently higher with the muscle groups than does the chinning. When the chinning is partialled out, or held constant, the other correlations drop somewhat, but when the pull is partialled out, the drop is considerably greater. The pull would seem, then, to be more closely related to the muscle groups, to be more indicative of their strength. The multiple correlations bear out this observation, pull correlating more highly with the other combinations than does chinning. The four variable multiple correlations further this conclusion by showing that the pull correlates more highly with the three muscle groups than does the chinning.

The results of this study demonstrate that a definitely positive relation exists between the ability to do the pull and to chin, and the strengths of the shoulder girdle muscles involved. It would also seem that the pull is superior to the chinning as an index of arm and shoulder girdle strength.

DIPPING, THE PUSH, AND CHIEF MUSCLE GROUPS INVOLVED

This study was undertaken in order to determine what relation there is between the ability to push and to dip, and the strengths of the shoulder girdle muscles involved, and to determine which of these two measures is the better index of this type of shoulder girdle strength. The pushes were scored by pound of push achieved. The dips were scored by the McCloy formula, which is: 1.1 dips + .78 weight + 74.[23] Those who did not succeed in completing one dip were allowed .78 of their weight as a score in this event. Muscle strengths studied included the anterior deltoids, pectorals, and forearm extensors taken by the Martin technique of measuring muscle strength.[30] The five variables were intercorrelated. All of the correlations were corrected for attenuation. By way of comparison the dips were rescored by the Rogers formula, which is: (D) (W/10 + H − 60).[34] The range for the dips scored thus extended from 0 to 250 with 69 of the first trials and 71 of the second trials at 0. Only 4 scores in each tabulation were above 125. This great predominance of zeros made further comparison impracticable as well as unnecessary. From this evidence it would seem safe to conclude that the McCloy method of scoring dips[23] is more indicative of actual dipping strength than is the Rogers formula.[34] Consequently scores computed by the McCloy formula[23] are used in this study. Table IV gives the results of the intercorrelations.

For the most part the push gives a higher correlation with the muscle strength than does the dips.

The relationships shown by the zero order correlations is low but positive. The muscle strengths show notably higher correlations with

each other than with the push or dips. Of the latter two, the push gives a higher correlation with more of the variables than does the dip. The

TABLE IV

INTERCORRELATIONS OF DIPPING, PUSH, AND CHIEF MUSCLE GROUPS INVOLVED

Dips—self correlation	.6449
Push—self correlation	.7562
Dips—push	.3811
Push—pectorals	.4520
Dips—pectorals	.3103
Push—anterior deltoids	.3292
Dips—anterior deltoids	.3598
Push—forearm extensors	.5393
Dips—forearm extensors	.2214
Pectorals—anterior deltoids	.7792
Forearm extensors—pectorals	.7254
Anterior deltoids—forearm extensors	.6557

TABLE V

PARTIAL CORRELATIONS OF DIPPING, PUSH, AND CHIEF MUSCLE GROUPS INVOLVED

	Zero	Order r
Dips, extensors—push	.0204	.2214
Push, extensors—dips	.5045	.5393
Dips, anterior deltoids—push	.2684	.3598
Push, anterior deltoids—dips	.2227	.3292
Pectorals, dips—push	.1673	.3103
Pectorals, push—dips	.7520	.4520
Pectorals, extensors—push	.6411	.7254
Pectorals, extensors—dips	.6734	.7254
Pectorals, anterior deltoids—push	.7484	.7792
Anterior deltoids, pectorals—dips	.7527	.7792
Anterior deltoids, extensors—push	.6014	.6557
Anterior deltoids, extensors—dips	.6330	.6557
Push, extensors—anterior deltoids	.4536	.5393
Dips, extensors—anterior deltoids	.2058	.2214
Push, extensors—pectorals	.3443	.5393
Dips, extensors—pectorals	—.0057	.2214
Push, pectorals—anterior deltoids	.3298	.4520
Dips, anterior deltoids—pectorals	.1977	.3598
Push, anterior deltoids—pectorals	—.0411	.3292
Anterior deltoids, extensors—pectorals	.2098	.6557

partial correlations give conflicting results. In some cases the partialling out of the push makes the correlation distinctly inferior, in some as obviously superior, while in several the differences are negligible. However, the multiple correlations show that the push correlates somewhat better than do the dips with other combinations. The four variable multiple correlations bear out this superiority.

The results of this study demonstrate that a positive relation exists between the ability to pull and to dip and the strengths of the shoulder girdle muscles involved. It would also seem that pushing is slightly superior to dipping as an index of arm and shoulder girdle strength.

TABLE VI

MULTIPLE CORRELATIONS OF DIPPING, PUSH, AND CHIEF MUSCLE GROUPS INVOLVED

0 1 2	*R*	*r* 1-0	*r* 2-0
Push—dips, extensors	.6022	.3811	.5393
Dips—push, extensors	.3014	.3811	.2214
Push—dips, anterior deltoids	.4331	.3811	.3292
Dips—push, anterior deltoids	.4538	.3811	.3598
Push—pectorals, dips	.7928	.4520	.3811
Dips—pectorals, push	.4112	.3103	.3811
Push—pectorals, extensors	.5466	.4520	.5393
Dips—pectorals, extensors	.3104	.3103	.2214
Push—anterior deltoids, pectorals	.4532	.3292	.4520
Dips—anterior deltoids, pectorals	.3628	.3598	.3103
Push—anterior deltoids, extensors	.5303	.3292	.5393
Dips—anterior deltoids, extensors	.4079	.3598	.2214
Anterior deltoids—push, extensors	.6564	.3292	.6557
Anterior deltoids—dips, extensors	.6916	.3598	.6557
Pectorals—push, extensors	.7289	.4520	.7254
Pectorals—dips, extensors	.7108	.3948	.7254
Pectorals—push, anterior deltoids	.8062	.4520	.7792
Pectorals—dips, anterior deltoids	.7799	.3103	.7792
Pectorals—push, dips	.4760	.5420	.3103
Push—pectorals, anterior deltoids, extensors	.6135		
Dips—Pectorals, anterior deltoids, extensors	.5814		

A COMPARISON OF BATTERIES

The Rogers' battery, which is in fairly wide use and which found its original inspiration in the intercollegiate strength test,[6] includes back and leg lifts, grips, and chinning and dipping strengths. Rogers also included lung capacity [34,35] which is omitted here. It is to be noted, also, that chinning and dipping strengths are scored in these studies according to McCloy's formula.[23] The push and pull are not included in the Rogers' battery,[34,35] but because of considerable evidence amassed in their favor, they are used in several of the batteries studied. The various batteries were first correlated with total strength (1) as represented by the combined scores of twenty-eight strength tests. As discussed below, a factor analysis showed that strength was the only important factor involved in these tests so the first factor loadings can be considered as the correlation of the test or battery with pure strength. From multiple regression equations based on first factor loadings, weightings were computed for the items in the battery from which pure strength could be measured, 1, 2, 3, as given at the top of the next page. The correlation of the weighted batteries with pure strength is also given. The three longer batteries gave the results found in the succeeding tabular material.

Of the three longer batteries, the intercollegiate with push and pull added (4) is the superior battery. However, the push-pull intercolle-

Battery	Total Strength	Pure Strength* First Factor Loadings	Weighted R Based on Factor Loadings
1. Intercollegiate with push and pull added (4)	r .8334	.9602	R .9119
2. Push-pull intercollegiate (3)	r .7988	.9516	R .8758
3. Intercollegiate (2)	r .8096	.9166	R .8742

* "Pure" strength as measured by this enlarged battery—this should not be interpreted to mean strength in an absolute sense.

giate (3) is definitely superior to the intercollegiate (2). Chinning and dipping are difficult whereas push and pull are simple in administration and scoring. The studies of chinning and dipping as compared to push and pull also indicated the superiority of the latter as measures of this type of arm strength. Considering this and the evident superiority of this battery (4) it would seem advisable to supplant chinning and dipping with pushing and pulling.

Among the shorter batteries the combination of grips, push and pull, chins and dips (5) when correlated with total strength (1) gave an r of .7921. Grips, push and pull (6) combined unweighted correlated with total strength (1) .6483. Weighted they gave an R of .6822. Grips, chin and dip (7) combined unweighted correlated with total strength .7326. Weighted, they gave an R of .7792. These correlations are notably inferior to those obtained through the use of the longer batteries.

The results of the first two parts of this study of intercollegiate type tests would seem to indicate that the pull is superior to chinning strength and that the push is superior to dipping strength as indices of shoulder girdle strength. Consistent with the results of the first two parts, the third part of this study demonstrates that while the best of the longer batteries for the prediction of total strength is the intercollegiate with push and pull added (4) a very close second is the push-pull intercollegiate (3) wherein the push and pull are substituted for chinning and dipping.

MARTIN TYPE TESTS

A study of the Martin type[30] tests was undertaken in order to investigate the use of this type of strength test in the prediction of total strength and to study the strengths of the different muscles, pairs of muscles, and muscle groups which are involved in some of the activities included in the intercollegiate type tests. The tests were given as has been previously explained. The knee extensors test was felt to be very unsatisfactory both in its administration and in the scores achieved. A possible explanation for the questioning of this particular test might lie in the fact that the point at which strength was applied for scoring is quite different from the practical application of that strength in activity.

In analyzing the data, correlations were computed between total strength and each of the muscles measured by the Martin technique.

Intercorrelations were also computed between the ten pairs of muscles and total strength. The complete table of correlations will be found in the section devoted to factor analysis. The average intercorrelations omitting total strength were then computed (Table VII). A factor analysis was made of the ten muscle pairs with total strength as the eleventh item. The table of factor loadings will be found on the section devoted to factor analysis. As is stated in the discussion of the factor analysis, only one factor is apparent, this one being obviously pure strength. The following table gives the correlations between the muscles and total strength, the pairs of muscles and total strength, the first factor loadings, and the average intercorrelations of the pairs of muscles.

TABLE VII

INTERCORRELATIONS OF MARTIN TYPE TESTS

Muscle		Total Strength	Total Strength (Left and right combined)	1st Factor Loading	Average Intercorrelation with other tests
Latissimus	*R*	.5647	.6242	.7275	.4709
	L	.6330			
Posterior deltoid	*R*	.5604	.6413	.7112	.4571
	L	.5509			
Pectorals	*R*	.6288	.7007	.8352	.5473
	L	.6712			
Anterior deltoids	*R*	.6005	.7063	.8174	.5315
	L	.6632			
Hip flexors	*R*	.6424	.6999	.7073	.4441
	L	.6520			
Thigh adductors	*R*	.5892	.6687	.7550	.4915
	L	.6530			
Knee flexors	*R*	.6321	.6665	.6251	.3818
	L	.6849			
Knee extensors	*R*	.3193	.3151	.3562	.2290
	L	.3688			
Forearm flexors	*R*	.6187	.6733	.7223	.4628
	L	.5647			
Forearm extensors	*R*	.3850	.4443	.4754	.3042
	L	.4079			

From this list the left latissimus, left pectoral, left anterior deltoid, left hip flexor and left knee flexor gave the highest correlation with total strength. These five were then combined to represent the Martin type tests.(8) When the muscles are correlated by pairs, left and right, with total strength, the pectorals, anterior deltoids, hip flexors, and knee flexors are among the top six. The first factor loadings show pectorals, anterior deltoids, latissimus, and hip flexors among those which correlated highest with pure strength. One difficulty lies in the fact that those which correlate well with total strength also correlate well with each other, while those which show low correlations with each other also show low correlations with total strength. Apparently this check on a

good battery cannot be applied here. The combination of five listed above would seem, then, to be a fairly good battery to represent the Martin type tests.(8)

The combination of five correlated with total strength .8077, which is practically the same as the intercollegiate battery (unweighted) correlation with total strength, .8096. The right and left grips were then added to the five Martin type tests(9) and correlated with total strength. The resulting correlation of .8612 is a notable improvement on the correlation of total strength with the five alone, .8077. Apparently, the grips add an important part to the battery. The combination of push, pull, grips, and knee flexors was then correlated with total strength, but the resulting r of .7804 is notably lower than correlations of other batteries with total strength.

Of the five chosen for the battery to represent Martin type tests, two are included in the four recommended by Wendler for the prediction of the total strength of men, and three are included in the six recommended by Wendler for the prediction of total strength of women.[4] In both of his batteries, leg extensors are included. In this study the knee extensor measurement was considered to be very unsatisfactory. Neither the subjects nor the experimentor felt that a fair estimate was being made of that muscle group. By the nature of their work, knee extensors would be expected to correlate highly with the leg lift. In this study the correlation between the two was found to be only .1999 which would seem to indicate that their strength is not accurately indicated by their score as measured according to this technique.

In another part of the study wherein all the correlations were corrected for attenuation, forearm flexors and extensors combined were found to give a correlation of .8657 with total strength. However, this high relationship is not again apparent in correlations between forearm flexors or extensors alone with total strength or with pure strength as shown by the first factor loadings. In the same part of the study wherein all of the correlations were corrected for attenuation, thigh flexors, extensors, and adductors combined gave a correlation of .8079 with total strength, practically the same as the correlation of the combination of five with total strength, .8077.

The Martin type tests have the advantage of requiring only relatively inexpensive and readily movable equipment. Also, their scores are immediately available in pounds so no formula has to be worked out for the computation of the amount of strength used, a distinct advantage from the point of view of both time and accuracy. They do not, however, make use of natural types of activities for their testing procedures. Resisting a pull does not seem to be as interesting to the individual as gripping, chinning, dipping, and other such activities as are employed in the testing procedures of the intercollegiate type. Furthermore, few of

our activities require the use of strength in resisting as it is tested by the Martin type tests. Martin himself did not advocate their use for predicting the total strength available for use in natural activities.[30] He pointed out their weaknesses in such circumstances and emphasized the value of their use in the treatment of infantile paralysis cases for the measurement of progress made.

Nevertheless, the combination of the five Martin type tests with the grips(9) correlated with total strength .8612 which is considerably better than the correlation with total strength .8334 of the best unweighted battery of the intercollegiate type. Considering the apparatus involved, the case of scoring and the high correlation with total strength, it would seem safe to conclude that the battery of five Martin type tests with grips added(9) can be used to advantage where a measure of total strength is needed.

FACTOR ANALYSES OF TWO GROUPS: INTERCOLLEGIATE TYPE TESTS AND MARTIN TYPE TESTS

Two factor analyses using Thurstone's method[40] were carried out with two groups of scores from the data. The intercollegiate type group included the chinning strength, dipping strength, back and leg lifts, right and left grips, the push, the pull, the intercollegiate battery (2), the intercollegiate with push and pull added (4), the push-pull intercollegiate (3), and total strength (1), which included the scores of all of this group in addition to the scores from all the Martin type tests. Lung capacity was omitted from the batteries. The second group included the ten muscle groups measured by the Martin technique and total strength (1) as explained above. The intercorrelations and reliabilities as well as the factor loadings are given below:

TABLE VIII

INTERCOLLEGIATE TYPE INTERCORRELATIONS AND RELIABILITIES

	Chin	Dip	B.L.	L.L.	Grips	Push	Pull	(2)	(4)	(3)	(1)
Chin	.9149	.7560	.3146	.4804	.3984	.3869	.5442	.5800	.6247	.5749	.6665
Dip		.6449	.3135	.5086	.3321	.3517	.3978	.6128	.6269	.5960	.6391
B.L.			.6939	.1875	.2378	.2060	.2924	.5593	.5546	.5901	.4863
L.L.				.6726	.2412	.2380	.3203	.7889	.7737	.8547	.6597
Grips					.7701	.2517	.4497	.4276	.4555	.4746	.4236
Push						.7562	.5449	.3840	.4824	.4289	.4475
Pull							.7068	.4807	.5521	.5606	.5839
Intercollegiate (2)								.7616	.9706	.9438	.8096
Intercollegiate—push and pull (4)									.8116	.9464	.8334
Push-pull intercollegiate (3)										.7278	.7988
Total strength (1)											.8138

When the items of the intercollegiate group are plotted, they cluster about the centroid or within one standard deviation of the centroid,* indicating that there is but one chief factor involved. This is also true

* There is no standard deviation available for the factor loadings of the Thurstone method of factor analysis. What was done here was to change the *intercorrelation* one

TABLE IX

INTERCOLLEGIATE TYPE FACTOR LOADINGS

Chin	.7266	Pull	.6373
Dip	.6952	Intercollegiate (2)	.9166
Back lift	.4916	Push-pull—intercollegiate (4)	.9602
Leg lift	.6790	Intercollegiate—chin and dip + push and pull (3)	.9516
Grips	.4873	Total strength (1)	1.0000
Push	.4909		

TABLE X

MARTIN TYPE INTERCORRELATIONS AND RELIABILITIES

	Lats.	P.D.	Pect.	A.D.	H.F.	T.A.	K.F.	K.E.	F.F.	F.E.	T.S.
Latissimus	.3407	.4999	.6934	.6454	.4290	.4780	.3475	.3310	.5414	.2676	.6242
Posterior deltoid	.5485	.5969	.6719	.3787	.5114	.3288	.2263	.5148	.3849	.6413	
Pectorals		.4590	.7471	.5537	.6592	.4495	.3136	.6478	.2632	.7007	
Anterior deltoid			.6146	.5551	.5369	.4158	.3416	.5504	.3195	.7063	
Hip flexors				.7002	.5242	.5467	.1447	.4819	.3830	.6999	
Thigh adductors					.6931	.5530	.2955	.4819	.3830	.6687	
Knee flexors						.6197	.1367	.4336	.2250	.6665	
Knee extensors							.5246	.1357	.1359	.3151	
Forearm flexors								.6624	.3768	.6733	
Forearm extensors									.4745	.4443	
Total strength										.8138	

TABLE XI

MARTIN TYPE FACTOR LOADINGS

Latissimus	.7275	Knee flexors	.6251
Posterior deltoid	.7112	Knee extensors	.3562
Pectorals	.8352	Forearm flexors	.7223
Anterior deltoids	.8174	Forearm extensors	.4754
Hip flexors	.7073	Total strength	.8973
Thigh adductors	.7550		

of the Martin type group. Because of this evidence in favor of the conclusion that there is but one chief factor in both analyses, there seemed to be no need for rotation. The factor indicated is obviously strength, not strength in relation to weight, endurance, courage, and so forth, but a sort of "pure" strength.

The first "factor loading" for the individual tests and for the batteries included may be considered as the correlations of these tests and batteries with *strength* as a pure factor. The batteries may be compared as to "validity" in this way. From this standpoint the intercollegiate battery with push and pull added (4) is the best, with the push-pull intercollegiate (3) a close second. Batteries rank as follows:

standard deviation (greater than it was originally) and retain the same vectors. The angle between the vectors was found by the formula:

$$\text{Cos. Angle} \quad x_{12} = \frac{r_{12}}{\angle_1 \angle_2}$$

If this angle became zero or became a quantity greater than one, it was assumed that the variables were "within one standard deviation of each other."

	Correlation with Strength	Batteries' First Factor Loadings
1. Intercollegiate with push-pull added (4)	*R* .9119	.9602
2. Push-pull intercollegiate (3)	*R* .8757	.9516
3. Intercollegiate (2)	*R* .8741	.9166
4. Grips, chin, dip (7)	*R* .7792	
5. Grips, push, pull (8)	*R* .6822	

Based on multiple regression equations using first factor loadings the approximate weightings from which pure strength can be measured are:

1. 3 chins + 1 dip + ½ back lift + ½ leg lift + ½ grips + 1 push +1½ pull.
   (Original equation: .3950 chins + .1419 dips + .0717 back lifts + .0566 leg lifts + .0539 grips + .1326 push + .1750 pull)
2. ½ grips — 1/10 push + 6 pull + ⅔ back lift + ½ leg lift.
   (Original equation: .0663 grips — .0013 push + .3365 pull + .0886 back lift + .0743 leg lift)
3. 3 chins + 1½ dips + ½ back lift + ½ leg lift + 1 grips.
   (Original equation: .2865 chins + .1555 dips + .1472 back lifts + .0589 leg lifts + .0744 grips)
4. 1 grip + 4 chins + 2 dips
   (Original equation: .0916 grips + .3856 chins + .2117 dips)
5. 1 grip + ½ push + 5 pulls
   (Original equation: .1077 grips + .0675 push + 5165 pull)

The push and pull were found to correlate .3497 with chin and dip. In case push and pull are obtainable where chins and dips are not, the latter could be predicted from the push and pull by the following formula derived from a regression equation based on the correlation between chins and dips, push and pull. C + D: .802 (push + pull) + 221.

As is pointed out on page 16, chinning and dipping are difficult whereas push and pull are relatively easy in administering and scoring. Furthermore, the studies of chinning and dipping as compared to push and pull indicate the superiority of the latter. However, norms now available use chin and dip. This equation is of value to weight the push and pull so that it can be used to fit into a strength index (McCloy's) in order that the norms now available may be used to compute physical fitness indices. Table XIV on pages 31 and 32 in the Appendix based on this equation was arranged to facilitate the change of push and pull scores into their equivalent in chin and dip scores.

The factor analyses of both groups, intercollegiate and Martin type, show clearly that, as would be expected, pure strength is the outstanding factor in these tests.

STRENGTH, POWER, AND ATHLETIC PERFORMANCE

This study was undertaken to determine to what extent the frequently mentioned "strength" and "power" influence athletic performance.

The strength factor in this study is considered in three ways. The total strength is the result of adding the scores of the back and leg lift, chins, dips, right and left grips, push, pull, and the ten muscle groups scored according to Martin's[30] technique. The physical fitness index was computed by adding the scores for back and leg lift, right and left grips, chins and dips for each individual, multiplying the total by 100, then dividing it by the norm for that individual's age and weight.[33,34,35] The Martin type tests were found to correlate so highly with strength that five outstanding tests were combined to give the Martin-type(8) strength test score. Total strength and the Martin type battery give the individual's attained score; physical fitness index scores strength according to what it should be for the individual's age and weight.

The Sargent jump is considered to be an excellent indication of the power of an individual, his explosive energy.[1,2,21,22,25,26,27,28] Power is differentiated from strength in that strength is measured as available *force* while power is determined by how effectively this force can be used at *speed;* power is *force* times *velocity*. Eleonore G. Adams, in her study of age, height, weight, and power as classification factors for junior high school girls used the Sargent jump as her measure of power.[1] Using records of 200 girls, she intercorrelated age, height, weight, Sargent jump, and a track and field score composed of the combined scores of three events, the potato race, broad jump, and basketball throw. From her zero order, partial, and multiple correlations she concluded, "Age, height, and weight alone are of very little value in classifying for athletic competition. Age might be used alone. The Sargent jump is almost as good as the Sargent jump and age for predicting track and field points, and height and weight add nothing of importance." In a group of studies involving the Sargent jump, McCloy found that the addition of the Sargent jump to a battery for purposes of classification resulted in a high correlation with a large battery of achievement tests.[26] He concludes, "The Sargent jump is not the one perfect test—but it is probably the best test we have for predicting explosive energy."

Mrs. Theresa Anderson, in her "Studies in Strength Testing for High School Girls" correlated the scores of 300 girls in the unweighted Strength Index, weighted Strength Index, unweighted P.F.I., weighted P.F.I., and Sargent jump against subjective ratings made by the instructor. She found that the Sargent jump was the best.[2]

Considering this evidence in its favor, the Sargent jump is used in this study as the power factor.

Because achievements in track and field have been shown to be most representative of an individual's athletic ability,[21,22] they are used for that purpose in this study. Records for the sixty-yard dash, six-pound shot-put, and standing broad jump were scored according to tables based on data from a large group and combined to give an athletic performance rating.[21,22]

To what extent does the strength of an individual affect her athletic performance? In order to answer this, the track and field scores combined were correlated with the total strength(1) score giving an r of .3959. The P.F.I. was then correlated with track and field resulting in an r of .3347. Four multiple correlations were computed giving the following results:

Track and field—Push-pull, intercollegiate weight..... R .3750
Track and field—Grips, push, pull, weight ..... R .3700
Track and field—Push-pull, intercollegiate (3) ..... R .3614
Track and field—Grips, chin, dip, weight ..... R .2960

Based on multiple regression equations, the weightings for the first two from which track and field scores can be predicted are:

Track and field = ¼ back lift + ⅓ leg lift + 1 grip + 1 push + 5 pull — 5 weight

(Original equation: Track and field = .0025 back lifts + .0366 leg lifts + .1082 grips + .1667 push + .5313 pull — .5160 weight)

Track and field = ½ grips + 1½ push + 6 pull + ½ weight

(Original equation: Track and field = .0562 grips + .1733 push + .6130 pull + .0688 weight)

The battery of five Martin type tests when correlated with track and field gave an r of .3169. Although these correlations are somewhat low, they show a definitely positive relationship between strength and athletic performance. It may, then, be assumed that the stronger individuals are superior to the weaker in athletic performance as judged by their track and field records.

Are individuals possessed of more power superior in athletic performance? For the answer to this question Sargent jump records were correlated with those for track and field. The resulting r of .5267 demonstrated that there is a positive relationship between power and athletic performance as judged by track and field scores. When the Sargent jump is partialled out or held constant, the correlation between track and field and P.F.I. is lowered, r is .2707. The partial correlation between track and field and the Sargent jump with the P.F.I. held constant is .4937 which would seem to indicate that the speed factor in power is more important to success in track and field than is the

* Since power is force times velocity, when the element of force (in this case the P.F.I.) is held constant, the resultant partial correlation approximates the effect of the velocity factor.

strength factor.* When Sargent jump and P.F.I. combined are correlated with track and field the multiple R is .5748. This would seem to indicate further that power is the more important factor in an individual's athletic performance.

TABLE XII

CORRELATIONS OF STRENGTH, POWER AND ATHLETIC PERFORMANCE

Zero order correlations:	
Track and field—Sargent jump	.5267
Track and field—Total strength (1)	.3959
Track and field—P.F.I.	.3347
Track and field—Martin type (8)	.3169
Sargent jump—P.F.I.	.2086
Sargent jump—Total strength (1)	.0744
Partial correlations:	
Track and field, Sargent jump—P.F.I.	.4937
Track and field, P.F.I.—Sargent jump	.2707
Multiple correlation:	
Track and field—Sargent jump. P.F.I.	.5748

From the results of this study it would seem that power, or the ability to contract the muscles under load at maximum speed, and strength are two important factors as far as their influence on athletic performance is concerned. Of the two, the speed factor in power is by far the more important so far as effecting changes in the ability to perform under normal circumstances is concerned.

RELATIONSHIP OF GIRTHS OF LIMBS AND JOINT WIDTHS TO STRENGTH OF LIMBS

It was the purpose of this part of the study to determine what relations the width of the knee and elbow joints and the girth of the limbs bear to their strength. This study was undertaken in two ways. Correlations were computed between the girth of the limb extended, corrected for fat, and the strength of the muscles of the limb involved. Further correlations were computed between the girth of the limb extended, corrected for fat,* and the joint width. Still another group of correlations was computed between the joint widths and the strength of the limb involved. Unless otherwise labeled, all of the zero order correlations in this part of the study were corrected for attenuation. The Martin type tests were used to measure the strengths of the various muscle groups.[30] The "leg lift" was taken according to Rogers' directions.[34] Unless preceded by the symbol R, these correlations represent zero order correlations between the sum of the strengths and the girth or joint width. If preceded by R, they mean the multiple correlation between the sum of the strengths and the combination indicated.

* The girths were corrected for fat by dividing the fat measurement, or measurements, by two, because of the double layer measured, multiplying that by pi and subtracting the result from the girth of the limb.

TABLE XIII

CORRELATION SHOWING RELATIONSHIP OF GIRTHS OF LIMBS AND JOINT WIDTHS TO STRENGTH OF LIMB

Forearm flexors and extensors—upperarm girth minus fat	.5262
Left grip—forearm girth minus fat	.5451
Upperarm minus fat—forearm girth minus fat	.4467
Thigh flexors, extensors, and adductors—thigh girth	.1170
Leg lift, knee flexors and extensors, thigh adductors and hip flexors—thigh girth (uncorrected for attenuation)	.3381
Leg lift—thigh girth minus fat	.4288
Thigh adductors—thigh girth minus fat	.1852
Upperarm girth minus fat—elbow width	.4091
Thigh flexors, extensors, and adductors—knee width	.2602
Leg lift, knee flexors and extensors, thigh adductors, and hip flexors—knee width (uncorrected for attenuation)	.4143
Knee flexors, leg lift, and thigh adductors—thigh girth	$R = .4357$
Leg lift, knee flexors and extensors, thigh adductors, and hip flexors—thigh girth and knee width	$R = .4260$
Upperarm strength—upperarm girth minus fat and elbow width	$R = .5207$
Forearm flexors and extensors—upperarm girth minus fat and elbow width	$R = .5600$

Approaching the situation from another angle, deviations from the norms of the Iowa Child Welfare Research Station were computed for the upperarm, forearm, thigh, and calf girths. These were correlated with the Physical Fitness Index (McCloy's revision).

Upperarm girth deviations with P.F.I.	.1241
Forearm girth deviations with P.F.I.	.1713
Thigh girth deviations with P.F.I.	.0089
Calf girth deviations with P.F.I.	.1932

Many have seemed to have assumed that the *relative* size of the arms and legs indicated their relative strength. The results of this study fail to show that such a relationship is consistently found in women of this age group. Neither does there seem to be any striking relationship between the girth of the limb and the width of the joint involved, nor between the strength of the limb and the width of the joint involved. This evidence of the slight relationship between girths and strengths of limbs and between relative limb girth and the physical fitness index should result in reorientation of thinking in this particular area.

CONCLUSIONS AND SUGGESTIONS

In regard to the intercollegiate type tests, there needs to be a re-study of the whole problem of arm strength scoring. In many activities, such as climbing and vaulting, the ability to pull the body up or push the body up, is important. Kinesiologically the strengths of the three muscle pairs studied with the push and dip, and the three muscle pairs studied with the pull and chin are justifiable criteria against which

to study the relative merits of the push, pull, chin, and dip. It is evident that the chin and dip as they are now being scored are not very good measures of the strengths of those muscles. The push and pull show some degree of superiority but are none too good. Some one needs to work out a better method of testing the chinning and dipping or pushing and pulling strength which would not be too complicated, involve too much time, or require too expensive apparatus.

The results of the study of intercollegiate type batteries indicates that the intercollegiate battery with push and pull substituted for chin and dip(3) is somewhat superior to the intercollegiate(2) for use in the prediction of total strength.

The study of Martin type tests shows that a representative battery of five correlates highly with total strength, that the addition of grips to this battery of five raises its already high correlation with total strength. A more extensive study is needed along these same general lines before a standardized battery can be presented with tables of norms. Considerable complaint has been made concerning the use of back and leg lifts for girls. So far no demonstrable harm has resulted despite the fact that thousands of girls have been tested. However, since the Martin type shows as good or better a correlation with total strength than does the intercollegiate type, there should be possibilities in the development of these tests which do not involve the back or leg lifts.

The factor analyses show that in the intercollegiate type and Martin type tests, pure strength is the one outstanding factor.

The study of the relation of strength and power to athletic performance shows that both strength and velocity are important factors, velocity being the more important of the two in so far as their influence on athletic performance is concerned.

The results of the study concerning the relationship of girths of limbs and joint widths to strength of limbs fail to show that the relative size of the arms and legs indicates their strength, as has been so commonly assumed. Neither does there seem to be any striking relationship between the strength of the limb and the width of the joint involved. This evidence of the slight relationship between girths and strengths of limbs and between relative limb girth and the physical fitness index should result in reorientation of thinking in this particular area.

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APPENDIX

BATTERIES STUDIED

1. Total strength includes scores from intercollegiate type tests, push, pull, and all the Martin type tests.

2. Intercollegiate includes back and leg lifts, chin, dip, and grips.

3. Push-pull intercollegiate consists of the tests included in the intercollegiate with push and pull substituted for chin and dip.

4. Intercollegiate with push and pull added includes those in the intercollegiate (2) with push and pull added.

5. Grips, push, pull, chins, and dips.

6. Grips, push, and pull.

7. Grips, chins, and dips.

8. Five Martin type includes the left latissimus, left pectoral, left anterior deltoid, left hip flexor, and left knee flexor.

9. Martin type with grips added includes the five Martin type (8) with the grips added.

Derivation of Formula for Correction for Attenuation

$$d = \delta;\ s = \sigma;\ E = \epsilon.$$

We may validly assume that:

Let $x_1 =$ 1st measure of x	$x_1 = x + d_1$	$r_{d_1 d_2} = 0$
$x_2 =$ 2nd measure of x	$x_2 = x + d_2$	$r_{E_1 E_2} = 0$
$y_1 =$ 1st measure of y	$y_1 = y + E_1$	$r_{d_1 E_2} = 0$
$y_2 =$ 2nd measure of y	$y_2 = y + E_2$	$r_{d_2 E_1} = 0$
$d_1 =$ errors of x_1	$x = x_1 - d_1$	$r_{x_1 E_2} = 0$
$d_2 =$ errors of x_2	$x = x_2 - d_2$	$r_{x_2 E_1} = 0$
$E_1 =$ errors of y_1	$y = y_1 - E_1$	$r_{y_1 d_2} = 0$
$E_2 =$ errors of y_2	$y = y_2 - E_2$	$r_{y_2 d_1} = 0$

$$r_{xy}\frac{\Sigma xy}{Ns_x s_y} = \frac{\Sigma(x_1 - d_1)(y_2 - E_2)}{Ns_x s_y} = \frac{\Sigma(x_2 - d_2)(y_1 - E_1)}{Ns_x s_y}$$

1. $\Sigma(x_1 - d_1)(y_2 - E_2) = \Sigma x_1 y_2 - \Sigma x_1 E_2 - \Sigma x_2 d_1 - \Sigma d_1 E_2$

(but since $r_{xy} = \dfrac{\Sigma xy}{Ns_x s_y}$ then $\Sigma xy = r_{xy} N s_x s_y$)

$$= N r_{x_1 y_2} s_{x_1} s_{y_2} - N r_{x_1 E_2} s_{x_1} s_{E_2} - N r_{y_2 d_1} s_{y_2} s_{d_1} - N r_{d_1 E_2} s_{d_1 E_2}$$

since $r_{x_1 E_2} = 0$
$r_{y_2 d_1} = 0$
$r_{d_1 E_2} = 0$

$$= N_{x_1 y_2} s_{x_1} s_{y_2}$$

DERIVATION OF FORMULA FOR CORRECTION FOR ATTENUATION (Continued)

$$d = \delta;\ s = \sigma;\ E = \epsilon.$$

2. $Nr_{x_2y_1}s_{x_2}s_{y_1}$

$$\Sigma x_1x_2 = \Sigma(x + d_1)(x + d_2) = \Sigma x^2 + \Sigma xd_1 + \Sigma xd_2 + \Sigma d_1d_2$$

$$Ns_x^2 + Nr_{xd_1}s_xs_{d_1} + Nr_{xd_2}s_xs_{d_2} + Nr_{d_1d_2}s_{d_1}d_2$$

since $r_{xd_1}s_xs_{d_1} = 0$

$r_{xd_2}s_xs_{d_2} = 0$

$r_{d_1d_2}s_{d_1}s_{d_2} = 0$

$$s_{x_2} = r_{x_1x_2}s_{x_1}s_{x_2}$$

$$r^2_{xy} = \frac{Nr_{x_1y_2} \cdot s_{x_1}s_{y_2} \cdot Nr_{x_2y_1} \cdot s_{x_2}s_{y_1}}{N(r_{x_1x_2}e_{x_1}s_{x_2}) \cdot N(r_{y_1y_2}s_{y_1}s_{y_2})}$$

The s's and the N's cancel out leaving:

$$r_{xy} = \sqrt{\frac{r_{x_1y_2} \cdot r_{x_2y_1}}{r_{x_1x_2} \cdot r_{y_1y_2}}}$$

TABLE XIV

Table for Converting Push and Pull Scores Into Chin and Dip Scores

Chin and Dip = .808 Push and Pull + 221

	0	1	2	3	4
10	229.08	229.89	230.70	231.50	232.31
20	237.16	237.97	238.78	239.58	240.39
30	245.24	246.05	246.86	247.66	248.47
40	253.32	254.13	254.94	255.74	256.55
50	261.40	262.21	263.02	263.82	264.63
60	269.48	270.29	271.10	271.90	272.71
70	277.56	278.37	278.18	279.98	280.79
80	285.64	286.45	287.26	288.06	288.87
90	293.72	294.53	295.34	296.14	296.96
100	301.80	302.61	303.42	304.22	305.03
110	309.88	310.69	311.50	312.30	313.11
120	317.96	318.77	319.58	320.38	321.19
130	326.04	326.85	327.66	328.46	329.27
140	334.12	334.93	335.74	336.54	337.35
150	342.20	343.01	343.82	344.62	345.43
160	350.28	351.09	351.90	352.70	353.51
170	358.39	359.17	359.98	360.79	361.59
180	366.44	367.25	368.06	368.86	369.67
190	374.52	375.33	376.14	376.94	377.75
200	382.60	383.41	384.22	385.02	385.83
210	390.68	391.49	392.30	393.10	393.91
220	398.76	399.57	400.38	401.18	401.99
230	406.84	407.65	408.46	409.26	410.07
240	414.92	415.73	416.54	417.34	418.15
250	423.00	423.81	424.62	425.42	426.23
260	431.08	431.89	432.70	433.50	434.31
270	439.16	439.97	440.78	441.58	442.39
280	447.24	448.05	448.86	449.66	450.47
290	455.32	456.13	456.94	457.74	458.55
300	463.40	464.40	465.02	465.82	466.63

TABLE XIV (Continued)

	5	6	7	8	9
10	233.12	233.93	234.74	235.54	236.52
20	241.20	242.01	242.82	243.62	244.43
30	249.28	250.09	250.90	251.70	252.51
40	257.36	258.17	258.98	259.78	260.59
50	265.44	266.25	267.06	267.86	268.67
60	273.52	274.33	275.14	275.94	276.75
70	281.60	282.41	283.22	284.02	284.83
80	289.68	290.49	291.30	292.10	292.19
90	297.76	298.57	299.38	300.18	300.99
100	305.84	306.65	307.46	308.26	309.07
110	313.92	314.73	315.54	316.34	317.15
120	322.00	322.81	323.62	324.42	325.23
130	330.08	330.89	331.70	332.50	333.31
140	338.16	338.97	339.78	340.58	341.39
150	346.24	347.05	347.86	348.66	349.47
160	354.32	355.13	355.94	356.74	357.55
170	362.40	363.20	364.02	364.82	365.63
180	370.48	371.29	372.10	372.90	373.71
190	378.56	379.37	380.18	380.98	381.79
200	386.64	387.45	388.26	389.06	389.87
210	394.72	395.53	396.34	397.14	397.95
220	400.80	403.61	404.42	405.22	406.03
230	410.88	411.69	412.50	413.30	414.11
240	418.96	419.77	420.58	421.38	422.19
250	427.04	427.85	428.66	429.46	430.27
260	435.12	435.93	436.74	437.54	438.35
270	443.20	444.01	444.82	445.62	446.43
280	451.28	452.09	452.96	453.70	454.51
290	459.36	460.17	460.98	461.78	462.59
300	467.44	468.25	469.06	469.86	470.67

Name..... Classification.....

1. Age
2. Weight
3. Height
4. Sitting height
5. Arm front
6. Forearm lateral
7. Forearm medial
8. Chest front
9. Theluum to umbilicus
10. Suprailiac
11. Thigh in front
12. Calf medial
13. Superscapular
14. Arm back
15. Chest depth
16. Chest width
17. Hip width bi-iliac
18. Trochanter width—no pressure
19. Elbow width
20. Knee width
21. Shoulder width
22. Chest circumference
23. Upper arm girth—flexed
24. Upper arm girth—extended
25. Above, corrected for fat
26. Forearm girth
27. Above, corrected for fat
28. Thigh girth
29. Above, corrected for fat
30. Calf girth
31. Above, corrected for fat
32. 60-yard dash
33. Standing broad jump
34. Six-lb. shot-put
35. Sargent jump
36. Pull-ups
37. Push-ups
38. Back lift
39. Leg lift
40. Right grip
41. Left grip
42. Push
43. Pull
44. Latissimus R.
45. Latissimus L.
46. Post. deltoid R
47. Post. deltoid L.
48. Pectorals R.
49. Pectorals L.
50. Ant. deltoid R.
51. Ant. deltoid L.
52. Hip flexors R
53. Hip flexors L.
54. Thigh adductors R.
55. Thigh adductors L.
56. Knee flexors R.
57. Knee flexors L.
58. Knee extensors R.
59. Knee extensors L.
60. Forearm flexors R.
61. Forearm flexors L.
62. Forearm extensors R.
63. Forearm extensors L.

The Research Specialist: His Role in Teacher Education

By Frank S. Lloyd, Ph.D.

Professor of Education, New York University

THE findings of research and the attitude of research are essential to any profession if it is to retain its vitality and have as its purpose an effective service to mankind and not the indoctrination of single idealogies, methods, or programs.

Teacher education, if it is to achieve its purpose, must be the area for the trying out of the findings of research. It must initiate research and conduct research in its own peculiar problems.

Education is coterminal for all research approaches, experimental, genetic, historical, and comparative. Its interests may be classified under the applied research heading, much more inclusively than the pure research classification. The criterion of its worth will be the degree to which it has immediate application—value to the problems of education people.

The supreme test of a profession is the importance which it attaches to its research, which ultimately necessitates that the findings of research be not only known to a few, but be known to all who are practicing the profession in such a way that they can select and try out such findings in their own situation. Further, research itself must be fostered and supported. Economy of money and time will demand that such research be of the applied type. Perhaps more important is the development of a research attitude: a problem-finding point of view in all teachers, which will recognize areas of inadequacy and initiate the desire to obtain more satisfactory answers.

I want to suggest that the least important cog in the scheme of research in teacher education is the research specialist. He becomes increasingly necessary as the more important steps in research, in teacher education are achieved. They are, in order of importance:

1. The development of the research attitude in every teacher, which includes the thrill in finding problems for which there are at present no satisfactory answers.

2. The ability to recognize that which has validity, along with the desire to find more satisfactory answers, and the knowledge of where to obtain help for more satisfactory answers.

A paper presented before the Teacher Training Section of the American Association for Health, Physical Education, and Recreation, April 1938, Atlanta.

3. The development of the research attitude in those who have the privilege of teaching teachers.

4. Encouragement to the few individuals who have the technical ability to conduct research, and what is just as necessary—time and money allowances.

5. The solicitation of guidance from research experts in many areas of specialization.

6. The attraction of the interest of research foundations to the problems of our particular field, with a view to their acceptance of some of these as research problems to which they will address themselves.

7. Research specialists who will devote a major part of their professional time to the direction of research.

I wish to discuss the characteristics of this person later in this paper. Before doing this, I desire to point out some research necessities, professionally and institutionally.

SOME RESEARCH NECESSITIES

I am assuming that education and, consequently, teacher education is a continuously progressive business and that research is the mother lode from which it will draw its inspiration. I am further assuming that the research specialist is a person who has a particular ability for this area of professonal inspiration.

In education he must be much more than a technician. He must be an educator with a research bent.

Research in education, teacher education, and physical education has been haphazard, dominated by a laissez-faire attitude. One of the most obvious necessities is some coordination of research efforts of individuals and institutions, resulting in a frank sharing of experience and expertness, rather than control. This should result in the recognition that some individuals and institutions are peculiarly fitted to render outstanding service in particular techniques. Individuals seeking guidance should be directed to these individuals and institutions rather than all institutions of teacher training becoming overnight experts in all techniques and areas of research.

There is a need for a clearing bureau for research—not under the direction or patronage of any particular institution, but supported by all and available to all. Such a bureau should provide a library service, be a clearing house for all research related to the particular field. It should be capable of providing guidance to students and faculty conducting research. It should provide synopses and annotated bibliographies, together with quarterly, semi-annual, and annual summaries of research organized under functional headings. One of its greatest contributions will be to bring to the field pertinent research technique and findings from other fields.

If the ultimate value of research in teacher education is the degree to which its findings permeate into every teaching situation, then there is an apparent need for the translation of pertinent research findings from all fields into quickly teacher-understandable language, and the wide circulation of such material in a manner that will make it immediately practical to the teacher.

Research in teacher-training institutions has tended to become pedantic. It needs the constant regeneration from the fields of research associated with business and other pragmatic areas, where the worship of techniques is softened by the necessity of quickly-obtained, practical answers. Cooperative advisory relationships need to be established institutionally and professionally to achieve this end.

The very essence of research is a frank sharing and the soliciting of criticism and verification or refutation by repetition, of experiment. Too often our research specialist has been much more of a propagandist than research specialist, a seller of wares rather than the searcher for better answers. The repetition of experimentation by other individuals is considered a slur on one's veracity rather than a compliment to one's research ability. The attitude appears to be that, once a piece of research provides an answer, truth has forever been established. The discoverer proceeds to defend it at all costs, discouraging rather than welcoming criticism. Having subscribed to the discovery of truth by criticism and experimentation, he proceeds to maintain that further truth—at least in the area of his experimentation—will be determined by dogmatization and propaganda.

THE RESEARCH SPECIALIST

Education, being an applied field, will find many of its problems best answered by research expertly conducted in related areas, e.g., physiology, sociology, etc. Some problems will be peculiar to education and consequently become the province of research in education. Such problems will center around activities, methods, facilities and equipment, and administration. The research specialist must be interpreted in the light of the needs of education.

A few generalizations present themselves:

1. That the majority of the teacher-training preparing institutions will not be able to support such a specialist.

2. The fields of physical education, health, and recreation being so large in scope, probably prohibit the support of a research specialist who is expert only in a given technique of research.

3. That such a person will have a teaching load beyond his research responsibility, and will be responsible for the guidance of others in research.

4. That the research conducted by or through such a person must have demonstrated educational value.

5. That in the economy of administration he will be the last to come and the first to go.

The research specialist in a teacher-preparing institution must be a director in research which will result in more effective teaching. In order to do this he must be:

1. A critical evaluator of present procedure and knowledge.

2. Capable of recognizing quickly problems and their relationship.

3. Be familiar with the various research techniques and know where to get help in these techniques for himself and others.

4. Know where to go to obtain information of a factual type.

5. Capable of translating into teacher-understandable language, current research.

6. Capable of helping students to discover *their* problems.

7. Capable of carrying a problem through to a successful conclusion.

Reversely, he should not be:

1. A one-track mind that sees only his specialty, either in technique or field, at the exclusion of other areas of interest.

2. Utilize students as stooges to solve problems of interest to himself, where the student did not have the opportunity to discover his own problem: to set up techniques for its solution, find the solution, or print results. The final result in this case becomes another chapter for the research specialist's proposed book.

3. A pat-on-the-backer, who believes that research is solved by excessive encouragement and not critical evaluation.

4. So interested in his own interests that he forgets his service to the field.

5. A propagandist, an administrator, or a laboratory technician.

The research specialist in teacher education is then much more of a specialist in research guidance, than a research specialist. He will be familiar with techniques that specialize on where to get help. Recognizing a problem when he sees one, he will be broad enough to follow a student rather than his own special interest. He will be an expert in translating scientific findings as they relate to education, and knowing where to obtain current information of this type: also, an expert in guiding others in their research endeavors and a coordinator of student faculty research.

Such a person is indispensable to any teacher-educating institution. Economically, he can be supported in smaller institutions by building courses, such as "trends," through which he could present current materials. In larger institutions he will perform a function of a director of research, perhaps assisted by specialists in particular techniques.

Unless some such person is more universally employed on teacher-training staffs, education, health, and recreation will be the types of fields where the mass of teachers rarely, if ever, come in contact with the findings of research related to their particular job; where the results of research lie undiscovered and unused by the only group for which they have value— the teacher; where the term "research" carries with it an association of pedagogical froth, and where modern techniques of education will continue to be determined by indoctrination and propaganda.

Recent Studies of American Adolescents as Guides for the Reorganization of the Secondary School Physical Education Program

By Rosalind Cassidy, Ed.D.

Chairman of the Department of Physical Education
Mills College

NEXT year or the year after, the writer probably would not have the temerity to present such a topic in this short space of time, but at this moment there is justification in the fact that most of the directors of recent studies of American adolescents are in that precarious period of organizing, summarizing, and interpreting results and are therefore reluctant to give out any statement on findings. My problem is both made more difficult and simplified by that fact. Therefore, what I propose to do with my time is to: (1) indicate some of the important studies now under way, (2) indicate what promise they give in aiding us in our problems, (3) state some of the questions they raise for education and physical education.

This group needs no one to emphasize the astounding picture which our country reveals in its search to solve the so-called youth problem in America. Ten million dollars is being expended by one organization alone in its efforts to define the problems in this area and make some of the answers available.

An important aspect of many of these studies, and one which promises much aid, lies in the fact that they are not the cross-sectional type of study where information is obtained concerning a number of individuals within a relatively short period of time, averages for various items computed, the norms set up. Most of the studies which I have chosen to mention here are longitudinal studies in which a given group of individuals is measured and otherwise studied at intervals throughout a relatively long period of time, with the result that information on the growth and development of individuals becomes available.

University of California, Institute of Child Welfare.—A group of approximately two hundred boys and girls, all at the same school level and averaging about ten and a half years in age, were selected for a study which commenced in 1932. These children represented an average California public school group. Anthropometric, psychological,

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A paper presented before the Research Section of the Southwest District Association, April, 1938, Salt Lake City.

and physiological measurements were made upon these children, together with observations of their school and family relationships. The study will be continued until they finish the senior high school. It closes in the spring of 1939 and should give a very complete picture of the growth of normal children.

University High School, Oakland, California.—A group of teachers in the University High School have been conducting a study of the members of one class through the three years of their attendance in the senior high school. Physical and psychological measurements are being made and records kept of interviews with the students and visits to their homes. Results from this study are now being summarized and will be published within the next year.

The Brush Foundation, Western Reserve University.—In 1933 a long-term study of adolescence was begun in which measurements were commenced upon a group of about three hundred children between the ages of seven and twelve. Measurements and observations have been made on the mental and physical development of these children with emphasis upon the study of their skeletal development by means of evaluation of X-ray photographs of the joints. This study will be continued until a large proportion of this group have reached eighteen

Harvard University—Shady Hill School.—In 1936 a systematic investigation was commenced of about fifty children in the age range from six to fifteen years to be extended over a four-year period in order to observe the earliest indications of puberty and the later phases of adolescence with particular reference to hormones, neurological development, skeletal development, and the incidence of fatigue, strain, and illness. At the same time a study of the personality development of these children was begun.

George Williams College—Study of Adolescent Boys.—This study is now reported in a book by Hedley S. Dimock, *Rediscovering the Adolescent,* published by the Association Press.

The Progressive Education Association—Commission on Secondary School Curriculum.—This commission has been engaging in a study of a group of young people between the ages of fourteen and twenty in several schools and colleges. Since these studies have extended over not more than three years, they have not emphasized growth and development as much as an attempt to make an intensive study of the personality development of young people through case-study methods. These findings are to be used by the subject area committees of the Commission as a basis for curriculum revision.

The Progressive Education Association—Commission on Human Relations.—This study has used the questions that children ask as a

basis for organizing a textbook called *Life and Growth*. It has been experimentally tried out in a number of schools and has now been published by D. Appleton-Century Company.

The General College of the University of Minnesota.—This study is not a longitudinal study since it is being conducted within a period of about one year. But by studying a typical group of General College students and at the same time a typical group of recent graduates of the University of Minnesota, an attempt is being made to relate the present group of students to a group which they may be expected to resemble within the next decade. In this study the emphasis is upon the attitudes of young people concerning problems of home and family life, health, education, and vocation. This study should show the present problems and needs of students and what these are after they have been out of college. This study is directed toward curriculum reorganization at the university level.

The Merrill-Palmer School—Family Consultation Service.—This study has carried on a four-year program of investigation to determine the after-college needs of seventy-five married women and twenty-five unmarried. Summaries are now being made of the case materials to arrive at implications for curriculum revision at the college level.

The American Youth Commission—American Council on Education.—The American Youth Commission is completing a number of surveys of the needs and characteristics of young people between the ages of sixteen and twenty-four. These studies are being made in an attempt to get a knowledge of the basic social and economic conditions of young people, and they are cross-sectional in nature. Homer Rainey in his recent report of progress of the work of the Commission in *How Fare American Youth,* states: "We must search for facts and face them. As we emerge from a lengthy period of economic doubt and despair, it is a service to youth and to society to examine and disclose as vividly as possible the real situation of our young people. How fare American youth in jobs and job finding, in schooling, in health, in leisure, in family, in the church, and in all that makes for character?" The American Youth Commission seeks answers to these questions by means of thorough field studies now under way in several American communities, by means of an investigation of various aspects of the Civilian Conservation Corps, and by numerous other researches and experiments.

The Studies Reported in "Middletown" and in "Middletown in Transition" by R. S. and H. M. Lynd.—These sociological studies of all aspects of what is claimed to be a typical American city have been fully reported in the first study made in 1925 and in the second one

ten years later. The areas of youth needs revealed in these reports are very helpful to educators.

Finally, I mention the recent publication of the American Council on Education, *Emotion and the Educative Process* by Daniel A. Prescott. This research was not a study of adolescents, like most of the others already mentioned, but could not have been completed without cooperation from these various studies. The author states that so much of the best contemporary thought had not found its way into publication that he had to spend a year visiting these centers of research in order to incorporate their findings. He has seen implications for education and suggests areas of needed research which are most helpful to those of us who wish to use the findings of the numerous studies recently completed or now under way.

Now let us ask, "How are these studies to serve us? What are the implications for the physical education program being offered to American adolescents? Do these studies verify and strengthen our present curriculum plan or show directions for change?" It seems to me there is clear indication:

That cooperative curriculum revision must be undertaken by all physical education staff groups competent to do so;

That studies in applying recent findings to practices in our field be set up and carried on over a period of time;

That wherever the organismic concept of individual and environment as a total unit is accepted pervasive changes must be made in the school buildings, selection of teachers, and selection of all other staff members, including janitors and matrons.

That work conferences should be widely organized to bring physical education teachers together to discuss and work out a clearer concept of the needs of young people and the contribution physical education may make toward their growth and development. Such conferences should clarify a philosophy of modern education and physical education. Such conferences should attempt to formulate a terminology which will not serve to confuse us and cause administrators to ignore physical education in the newer curriculum plans.

That our program must be based on individual differences and needs—that more skillful techniques of guidance be used to help the individual see his goals, plan to achieve them, and proceed to carry out the plan, evaluating progress from time to time.

That physical education teachers must *use* more skillfully the tools now available for individual diagnosis and adjustment, and must develop more adequate ones.

That better methods of observing symptomatic behavior and more insight in such observation be developed.

That better ways of recording total child growth be developed and that the best techniques now available in other fields be used by physical education teachers.

That physical education teachers see their task the same as any other teacher in the school—that of integrating the child, not primarily that of teaching skills.

That the needs of adolescents are the first area to which one turns in setting up a curriculum study.

That teachers must be more carefully selected, must be given a much more meaningful major course, and must know more about children.

That patterns of cooperation are more needed in our culture than those of competition. We must give children many more ways to enjoy group enterprises.

That differences in body architecture are often very significant signs of need for an adjusted program.

That need for social success with the opposite sex indicates development of co-activities along best lines.

That broader preparation of physical education teachers is essential if they are to understand and see their contribution to core courses.

That coordinating the school and community program in more meaningful ways is a task to be attacked.

These are only a few of the implications stated in very general terms. The problem seems to be a very important one. Our greatest service to society is ahead if we can intelligently interpret our contribution to the total educational task. The time is a crucial one. Now we must either grow along with the pervasive changes in education as a whole or be left behind as out-moded, our contributions being made, certainly, but called by other names and organized into quite different program units and experiences than those now offered, changes which preferably should come through the thoughtful work of members of the physical education profession rather than through those outside of it who consider us not equal to the task.

Studies Relating to Achievement Scales in Physical Education Activities

By Naomi Russell
Girls' Physical Education Department
and Elizabeth Lange
Mathematics Department
Marina Junior High School, San Francisco

I

The Practicality of Using Achievement Scales when Determining Marks in Junior High School Physical Education

THE Marina Junior High School in San Francisco has an enrollment of fourteen hundred, so that the two women instructors in the physical education department are responsible for approximately seven hundred girls. With this many marks to make out at the end of each six weeks period, the instructors have found it necessary, as well as desirable, to make the marking system as objective as possible. This report gives the results of certain experiments which were tried in order to determine the practicality of using achievement scales, such as those of Neilson and Cozens[1] to help determine these marks.

For two terms the following method of marking was used. Each girl started a marking period with 80 points, which might be lost because of absence, tardiness, incomplete costume, or poor citizenship. She could gain points by taking a shower each physical education period and by attaining skill in athletic activities. Marks were determined by making a frequency distribution of the total points earned by each of the girls and allotting A's, B's, C's, D's, and F's according to the San Francisco junior high school marking system. This method was found to be satisfactory in every respect except that of testing for skill in athletic activities. It was difficult to find or to construct skill tests that fulfilled the three requirements, which (1) were based on a reliable standard of performance, (2) took into consideration the differences in maturity of students in the same grade of school, and (3) were easy to administer.

During the first year, skill tests found in various publications or constructed by the teachers were used, and after frequency distributions of the performances had been constructed, points were allotted to the members of each class. There was no attempt made to classify

[1] N. P. Neilson and F. W. Cozens, *Achievement Scales in Physical Education Activities for Boys and Girls in Elementary and Junior High Schools.* (New York: A. S. Barnes and Co. 1934. Hereafter in this report, this book will be referred to as the "N-C Scales."

students by age, height, or weight, and as time went on the instructors became more and more dissatisfied with the situation. Again and again small girls who were exerting themselves to the utmost received low marks in skill tests because their heavier and taller classmates could attain high scores with equal or less effort. It was felt that this situation could be remedied by the use of achievement scales based on a classification by age, height, or weight, or a combination of these factors, and so the available material on the subject was studied.

Attention was first given to the California Decathlon Tests used by the City Physical Education Department several years before but abandoned because so much time was spent in practice for the tests and in taking and scoring them that there was little time left for the playing of games. The next study to be reviewed was the volume by Neilson and Cozens which to some extent owes its inception to the California Decathlon Tests. In many respects the N-C Scales were ideal. They were based on age, height, and weight, so that maturity was carefully handicapped, and they were constructed from the performances of several thousand students and could therefore be considered reliable. Furthermore, scores on the different tests were of the same type and could be compared or averaged.

But one serious objection to the N-C Scales was the fact that each student had to be classified at the time each test or battery of tests was administered. For us, this meant that for each girl the following procedures had to be carried out three times each term.

1. From her date of birth, her age in years and months had to be found on a chart specially constructed for this purpose, and from a table in the book a number, called an exponent, had to be found for age.
2. Her weight had to be taken and from the N-C table an exponent for weight had to be found.
3. Her height in inches had to be measured and from the N-C table an exponent for height had to be found.
4. The sum of the exponents had to be computed and from this sum the "class" of the girl had to be found.

This method, of course, would classify all the girls into eight "classes," from A to H, according to maturity, but when it was realized that the procedure would involve a tremendous amount of clerical work, the idea of using the N-C Scales was discarded.

About this time the National Physical Achievement Standards for Girls[2] came under consideration and it was decided to try out these standards because they took maturity of a certain type, that is age, into account. These standards were easy to use because if the age in years and the performance in one of the tests were known, a score of from 0 to 10 could be found quickly from the N.P.A.S. tables. Therefore

[2] *National Physical Achievement Standards for Girls*, prepared by Amy Howland for the National Recreation Association. Hereafter this pamphlet will be referred to as N.P.A.S.

in August, 1937, certain skills in athletic activities for which there were tests in the N.P.A.S. pamphlet, were used in marking the students.

The results were far from satisfactory. The scale of from 0 to 10 provided only eleven intervals on a frequency distribution so that an attempt to distribute the marks according to the percentage system recommended by the school administrators resulted in the division points in the marks coming at the middle of intervals with large frequencies. Then, too, while classification by age did take care of a few cases of unfairness of mark due to immaturity, still in each group of girls of the same age there were noticeable examples of tall, heavy girls who had the ability but did not perform better than much smaller girls. They would, however, receive the same score and mark. It became evident that the N.P.A.S. could be used for our purpose only if modified, and so the physical education teacher went to the mathematics teacher with three problems, which she felt were statistical. These problems were: (1) How can we refine the N.P.A.S. scoring so that we shall have 20 or 30 intervals instead of 11 when frequency distributions of the scores are made? (2) How can we find out whether handicapping our girls for height and weight will make a difference in their marks? (3) How can we modify some of the N-C Scales so that they are comparable to the N.P.A.S. and hence can be used to supplement them?

The mathematics teacher studied both types of achievement scales and replied with the question: Since the N-C method seems to be statistically sound, since it classifies students according to age, height, and weight, and since its range in scores is from 0 to 100 and so furnishes more than enough intervals, why not find a way to use it? Once more the physical education teacher enumerated the difficulties. Seven hundred girls had to be classified three times a semester. The teachers did not have time to do the classifying nor did they have the time nor the place to teach the students to classify themselves. Then the obvious solution became clear. The classification involves the reading of numbers, the use of numerical tables, the addition of short columns of figures, and the accurate recording of data. These are all mathematical activities. If a place could be found in the mathematics course of study for these exercises, several mathematics classes might be used for the work and it would furnish not only a practical application of otherwise humdrum drill, but also a modest example of integration between two departments. This suggestion seemed possible and so the following problems were undertaken.

PROBLEM ONE

Object.—To determine whether use of the N.P.A.S. tables would result in the same marks as those produced from the N-C Scales.

Procedure.—Two tests, the "Jump and Reach" and the "Basketball Throw for Distance," were chosen because they were found in both

books, because they tested very different skills, and because they were simple to administer. Approximately 165 girls were chosen at random from classes in the seventh, eighth, and ninth grades. Each girl had three trials in each event and the best effort of the three was recorded as her performance in that test. Her age was recorded and on the basis of her performance and her age her score on that test was found from the N.P.A.S. scales. Next, using the same performance record, the instructor classified each girl according to the N-C method and found her score on the N-C Scales.

When all the girls had received scores in both tests according to both methods, two comparisons were made. First, the N.P.A.S. scores were correlated with the N-C scores of the same girls in the same test. Second, frequency distributions were made of the scores and marks were assigned to students as nearly as possible according to the following plan: highest 15 per cent = A; next 35 per cent = B; next 35 per cent = C; next 10 per cent = D; and lowest 5 per cent = F. In using these per cents it was necessary to adjust to the awkwardness of the N.P.A.S. intervals for this type of marking, but because of the large number of intervals on the N-C Scales, such adjustments were not needed. The two marks each student received for her best trial in an event were recorded side by side. Wherever there was a difference in the two marks a check was placed on the record. These checks were counted and the per cent of students receiving them was found.

The results:

BASKETBALL THROW FOR DISTANCE

Number of girls	165
Correlation coefficient, between N.P.A.S. scores and the N-C Scores	.88 P.E. ± .01
Number of differences in marks	48
Per cent of differences in marks	29 per cent

JUMP AND REACH

Number of girls	162
Correlation coefficient between N.P.A.S. scores and the N-C Scores	.88 P.E. ± .01
Number of differences in marks	33
Per cent of differences in marks	20 per cent

BOTH EVENTS

Number of girls	159
Number with different marks in both events	11
Per cent with different marks in both	7 per cent

CONCLUSION

Before drawing a conclusion, the results were presented to a seminar class studying problems in secondary education at the University of California at Berkeley. The members of the seminar agreed that from the above results it may be concluded that for purposes of marking

both methods of scoring cannot be correct. If the N.P.A.S method is correct the N-C method is not, and vice versa, because if both were correct the marks should come out practically the same and the correlations should be practically 1.00. If it is possible to decide that one of these methods of scoring students is definitely just and reasonably accurate, then it is an error to use the other method.

Since the two types of scales could not be used indiscriminately, a careful evaluation of the two was made based on the standards set up by McCloy,[3] and the arguments presented in the N-C book. The N-C Scales were accepted as the correct ones for marking because the arguments in favor of classification by age, height, and weight as against age alone were hardly refutable. Furthermore, the longer the N-C method was studied the more it appealed to the investigators. The method of weighting the factors of age, height, and weight seemed scientific and generally acceptable, the classification chart was really easy to use, and the explanations of the methods used in constructing the scales were so clear that it would be possible to devise tests not included in the books. By keeping records of performances of students over a period of time rating scales could be constructed like those in the N-C book. Because of all these considerations the decision was made to use the N-C Scales provided the mathematics department would be willing to classify the students. That department became interested in the problem but felt that it might be sufficient to classify the students once each term. To decide this question, Problem Two was formulated.

PROBLEM TWO

Object.—To determine whether it would be sufficient to classify the students at the beginning of each term if the N-C method were used.

Procedure.—For this experiment a group of 123 girls were chosen at random from the various physical education classes. Their ages, heights, and weights were found and recorded in September, October, November, and December of 1937. After each recording, each girl was classified by the N-C method. In December each girl was asked to run the 40-yard dash. Her performance was recorded and she was assigned a score in the dash based on her class as of December. The same performance was scored according to her class as of September. Thus for each girl there was the score in the 40-yard dash which she would receive had she been classified only in September with the dash run in December, and the score she would receive if she had been classified at the time the dash was run in December.

It was soon realized that a conclusion based on one event would be unsatisfactory, but there was insufficient time to obtain performances of these students in other events during the month of December. How-

[3] C. H. McCloy, *Measurement of Athletic Power*. (New York: A. S. Barnes and Co., 1932).

ever, all the girls used in Problem Two had also been used in Problem One, and so the performances the girls had made in the "Jump and Reach" and the "Basketball Throw for Distance" were used as though they had been made in December. Scores based on both the September and December classifications were assigned to each girl in these events. There were now six scores for each of the 123 girls, one for each of three events if the girls had been classified in September, and one for the same performance in the same three events if the girls had been classified in December. It was assumed that all performances were made in December. Each series of scores was arranged in a frequency distribution and marks were allotted as they would be if the tests were being used to award points for a report card mark.

These were marked according to the percentage scale mentioned above. In every event it was possible to keep the number of each mark given for the September classification within one of the number given of that mark in December classification while allotting the marks as one would in a real classroom situation. After the marks were assigned, the following were tabulated: the number of changes in classification for each month (that is, the number of girls who moved into a higher class because of increase in age, height, or weight); the number of changes in class for the whole series; and the number of girls who were really receiving the wrong mark in December if they were classified in September only. In order to compare the results of Problem Two with the results of Problem One, the marks in the 40-yard dash according to the N.P.A.S. Scales were obtained, and the per cent of students with a difference of grade of the type discussed in Problem One was obtained in this event.

The results:

CHANGES IN CLASS

Number of students classified	123
Changes of class from September to October	12
Changes of class from October to November	11
Changes of class from November to December	3
Number of students with two or more changes	0
Number of students with change of more than one in class	0
Total changes	26
Per cent of students with change of class by December	21

WRONG MARKS THAT WILL BE GIVEN IF STUDENTS ARE CLASSIFIED IN SEPTEMBER ONLY

Number of errors in 40-yard dash	0
Per cent errors in 40-yard dash	0
Number of errors in "Jump and Reach"	7
Per cent of errors in "Jump and Reach"	6
Number of errors in "Basketball Throw for Distance"	20
Per cent of errors in "Basketball Throw for Distance"	16
Average number of errors	9
Average per cent of errors	7

COMPARISON OF RESULTS OF PROBLEM ONE WITH THE RESULTS OF PROBLEM TWO

	Problem One	*Problem Two*
Per cent of errors in marks in the 40-yard dash..	7	0
Per cent of errors in marks in the "Jump and Reach"	20	6
Per cent of errors in marks in the "Basketball Throw for Distance"	29	16
Average per cent of errors in marks.....	18.5	7.3

CONCLUSION

From these results it was concluded that if students were classified only once each term by the N-C method, there would be less than half as many errors in student marks than if the N.P.A.S. method were used. The wide range in the per cent of error (0 — 6 — 16) makes further investigation advisable. The mathematics department was requested to classify all the girls in January, 1938.

PROBLEM THREE

While the physical education department was working on Problem Two, the mathematics department experimented with the possibility of using the computation of classifications as a mathematics lesson. There were two possible places where it might be included in the course of study. One was in the seventh grade where a great deal of simple review material seemed desirable and the other in the ninth-grade general mathematics course where an application of mathematics to the real life of the child or school was especially welcome. The seventh grade was used for these experiments because there were at least ten sections of seventh-grade mathematics and the students in them had been segregated according to mental age and mathematical ability.

In November, 1937, a preliminary lesson was given to three seventh-grade groups, two "X" groups and one "Y" group. It was found that the students in all of these groups were interested in classifying themselves or other students and could be taught to do the classification accurately in one period. Four mathematics teachers were consulted and all felt that the project was worth while. Hence, the following plan was evolved and followed in December 1937 and in January 1938.

1. Under the supervision of the art department, wall copies of the N-C charts were made by four seventh-grade boys.

2. The physical education department had a card printed for use in the classification of each girl. When the girls were measured and weighed in January, a recorder wrote the height, weight, and date of birth of each girl on her classification card. These cards when completed were sent to the mathematics department.

3. Mrs. Roberta MacLane of Marina Junior High became very much interested in the problem and consequently eight seventh-grade mathematics classes were available for classifying the seven hundred

girls. Six classes were actually used—two "X" groups of the high seventh grade, one "Y" and one "Z" group of the high seventh, an "X" group of the low seventh, and a "Y" group of the low seventh.

4. The pupils in all of these groups were told the purpose of the lesson and therefore responded with eager interest. Here was something *real* for them to do. In each class, the first step in the lesson was to teach the whole class to classify the same student. The teacher recorded the results on the card. After a class had repeated the operation several times, data from one card were dictated to a row of students and in this way six cards could be completed at a time. Finally, if the calibre of the class warranted, students were paired in teams of two and each team was given 6 to 10 cards to do and check. The "X" and "Y" groups could be trusted to do careful work in teams of two. The "Z" group handled the classification by rows very well but only outstanding individuals in this group were allowed to work in teams of two. By this method 700 girls were classified in three days.

Both children and teachers agreed that the following values were to be found in this lesson:

Motivation.—Because the students were doing something which they orally expressed as "real," their interest in mathematics and physical education was stimulated.

Responsibility.—Because the physical education department trusted seventh grade pupils to do an important piece of work, their sense of responsibility was heightened.

Accuracy.—Because the marks given to girls in physical education depended on their work, the mathematics students were conscientiously accurate in number reading, computation, and the recording of data.

Reasoning.—Because the students had something real to work on, they were alert to errors of all types and used their common sense in checking their own and their partner's results. They also looked for and found mistakes made by the original recorders of data and did not hesitate to call attention to these mistakes.

Neatness.—Because the cards belonged to another department and were to be used all term, the students were taught to be neat in the recording of results.

Orientation.—Because the low seventh-grade girls were taught the method of marking in physical education, their adjustment to the junior high school situation was facilitated.

From those points of view, the mathematics department was convinced of the value of including computation of the classifications as a mathematics lesson. If the physical education department should decide that the N-C Scales are a partial answer to its marking problem, then the classification of students should be included in the seventh-grade course of study.

SUMMARY

1. A need was felt for objective tests in skills to be used in marking girls in junior high school physical education.

2. Achievement Scales based on age alone seemed to be unsatisfactory.

3. Marks found from scales based on age alone were compared with marks found from scales based on age, height, and weight (Problem One).

4. Errors in marks which would result if students were classified by age, height, and weight at the beginning of the term only and tested throughout the term were compared with errors in marks if students were classified by age alone whenever tests were given (Problem Two).

5. Classification of seven hundred girls in physical education was tried out in seventh-grade mathematics classes (Problem Three).

CONCLUSIONS

1. From Problem One it was concluded that marks based on classification by age alone were unfair to students and should not be used.

2. From Problem Two it was concluded that there will be less than half as many errors in marks if students are classified by age, height, and weight only once a term, than if they are classified by age only at the time a test is given.

3. From Problem Three it was concluded that seventh-grade mathematics classes can accurately classify all of the physical education students within a reasonable time and simultaneously attain valuable skills and habits in mathematics.

4. From the whole investigation it was concluded that:

a) Teachers and pupils when they became familiar with the N-C type of classification are convinced of its fairness and want to use it.

b) Departments in the junior high school are eager for opportunities to correlate their work with other departments.

c) Investigations of the type discussed can be carried out by the classroom teacher in a real school situation with results that are practical enough to warrant the time and effort they require.

II

Achievement Scales in Girls' Basketball in the Junior High School

A study of basketball as played by girls in the junior high school convinced us that there are at least four fundamental skills essential to the game. These are: (1) jumping and reaching, (2) goal shooting, (3) passing and catching, and (4) dribbling. Achievement scales, based on a classification by age, height, and weight, for the first two skills are to be found in the Neilson-Cozens book entitled, *Achievement Scales in Physical Education Activities for Boys and Girls in Elementary and*

Junior High Schools. The titles of these two scales are, "Jump and Reach" and "Basketball Throw for Goal."

To measure the other two skills, two tests called the "Basketball Throw and Catch" and the "Basketball Dribble for Distance" were constructed and used at the Marina Junior High School in the fall of 1937. Later the aid of several schools was obtained and by March of 1938 data were in hand for both tests from over one thousand girls in the seventh, eighth, and ninth grades. The schools contributing data were the Auburn High School, Los Gatos High School, Santa Rosa High School, and the George Washington Senior High, Presidio, and Marina Junior High Schools of San Francisco.

In constructing these scales the techniques discussed in the Neilson-Cozens book, pp. 161-171 were followed. The number of girls in each class varied from 8 to 239, the average being 125. In classes D to H for the "Dribble for Distance" and classes E, F and G for the "Catch and Throw" the distributions were skewed and had to be given special treatment. These scales are good preliminary studies of the two tests. It is planned to collect as many records as possible each semester the tests are used and then revise the scales if the data collected seem to demand it. Contributions and comments from others who may use the scales are desired.

The descriptions of the tests and the scales follow. In using the scales instructors must classify their students by age, height, and weight as described in the Neilson-Cozens book, pp. 3-9.

Basketball Dribble for Distance

Description—

An official fully inflated basketball is used. A 10-foot line is drawn. Pupil stands behind this line with basketball in hand. Pupil bounces ball once and catches it, attempting to cover as much distance as possible from the time the ball leaves the hands until it is caught. The pupil must stop the moment the ball is caught. The ball must not go above the head at any time during the dribble.

Testing Procedure:

1. Measure distance from starting line to pupil's rear foot when the ball is caught.
2. Record to nearest half inch.
3. Three trials are allowed.
4. The best trial is the pupil's record.

Basketball Throw and Catch

Description—

An official fully inflated basketball is used. The pupil stands at the throwing line. At signal "Go," pupil throws the ball (chest throw) against the wall, catches it, and continues to throw and catch until "Stop" is called.

Testing Procedure:

1. Mark a 10-foot line, parallel to and 5 feet from suitable inside or outside wall.

2. Call "Ready! Go!" Record number of times the pupil catches the ball in 30 seconds.
3. Pupil must stay behind line.
4. Balls not caught (picked up) do not count.
5. Three trials are allowed.
6. Time allowed for each test is 30 seconds.
7. The best trial is the pupil's record.

BASKETBALL DRIBBLE FOR DISTANCE (DISTANCE IN FEET AND INCHES)

Score	Classes								Score
	A	B	C	D	E	F	G	H	
100	12-7	13-11½	15-2	16-2	17-0	18-6½	19-0	21-0	100
99	12-6	13-10	15-½	16-½	16-10½	18-4	18-10	20-9½	99
98	12-4	13-9	14-11	15-10½	16-8½	18-2	18-8	20-7	98
97	12-3½	13-7½	14-9	15-9	16-6½	18-0	18-5½	20-4½	97
96	12-2½	13-6	14-7½	15-7	16-5	17-10	18-3½	20-1½	96
95	12-1	13-4½	14-6	15-5½	16-3	17-7½	18-1½	19-11	95
94	12-0	13-3½	14-4½	15-4	16-1	17-5½	17-11	19-8½	94
93	11-11	13-2	14-3	15-2	15-11½	17-3½	17-9	19-6	93
92	11-10	13-½	14-1½	15-0	15-9½	17-1½	17-6½	19-3	92
91	11-8½	12-11	14-0	14-10½	15-7½	16-11	17-4½	19-½	91
90	11-7½	12-10	13-10½	14-9	15-6	16-9	17-2½	18-10	90
89	11-6½	12-8½	13-9	14-7	15-4	16-7	17-0	18-7½	89
88	11-5	12-7	13-7½	14-5½	15-2	16-4½	16-10	18-5	88
87	11-4	12-5½	13-6	14-3½	15-½	16-2½	16-8	18-2	87
86	11-3	12-4½	13-4	14-2	14-10½	15-½	16-5½	17-11½	86
85	11-1½	12-3	13-2½	14-0	14-8½	15-10½	16-3½	17-9	85
84	11-½	12-1½	13-1	13-10½	14-7	15-8	16-1½	17-6½	84
83	10-11½	12-0	12-11½	13-9	14-5	15-6	15-11	17-3½	83
82	10-10½	11-11	12-10	13-7	14-3	15-4	15-9	17-1	82
81	10-9	11-9½	12-8½	13-5½	14-1	15-2	15-6½	16-10½	81
80	10-8	11-8	12-7	13-3½	13-11½	14-11½	15-4½	16-8	80
79	10-7	11-6½	12-5½	13-2	13-9½	14-9½	15-2½	16-5	79
78	10-5½	11-5½	12-4	13-0	13-7½	14-7½	15-0	16-2½	78
77	10-4½	11-4	12-2	12-10½	13-6	14-5½	14-10	16-0	77
76	10-3½	11-2½	12-½	12-8½	13-4	14-3	14-8	15-9½	76
75	10-2	11-1½	11-11	12-7	13-2	14-1	14-5½	15-6½	75
74	10-1	11-0	11-9½	12-5½	13-½	13-11	14-3½	15-4	74
73	10-0	10-10½	11-8	12-3½	12-10½	13-9	14-1½	15-1½	73
72	9-11	10-9	11-6½	12-2	12-8½	13-6½	13-11	14-11	72
71	9-9½	10-8	11-5	12-0	12-7	13-4½	13-9	14-8	71
70	9-8½	10-6½	11-3½	11-10½	12-5	13-2½	13-7	14-5½	70
69	9-7½	10-5	11-2	11-8½	12-3	13-½	13-4½	14-3	69
68	9-6	10-3½	11-½	11-7	12-1½	12-10	13-2½	14-½	68
67	9-5	10-2½	10-11	11-5	11-11½	12-8	13-0	13-9½	67
66	9-4	10-1	10-9	11-3½	11-9½	12-6	12-10	13-7	66
65	9-2½	9-11½	10-7½	11-2	11-8	12-4	12-8	13-4½	65
64	9-1½	9-10	10-6	11-0	11-6	12-1½	12-5½	13-2	64
63	9-½	9-9	10-4½	10-10½	11-4	11-11½	12-3½	12-11½	63
62	8-11½	9-7½	10-3	10-8½	11-2½	11-9½	12-1½	12-8½	62
61	8-10	9-6	10-1½	10-7	11-½	11-7	11-11	12-6	61
60	8-9	9-4½	10-0	10-5	10-10½	11-5	11-9	12-3½	60
59	8-8	9-3½	9-10½	10-3½	10-9	11-3	11-7	12-1	59
58	8-6½	9-2	9-8	10-2	10-7	11-1	11-4½	11-10	58
57	8-5½	9-½	9-7	10-0	10-5	10-10½	11-2½	11-7½	57
56	8-4½	8-11	9-5½	9-10½	10-3	10-8½	11-0	11-5	56

BASKETBALL DRIBBLE FOR DISTANCE (DISTANCE IN FEET AND INCHES)

Score	Classes								Score
	A	B	C	D	E	F	G	H	
55	8-3	8-10	9-4	9-8½	10-1½	10-6½	11-10	11-2½	55
54	8-2	8-8½	9-2½	9-7	9-11½	10-4½	10-8	10-11½	54
53	8-1	8-7	9-1	9-5	9-9½	10-2	10-5½	10-9	53
52	8-0	8-5½	8-11½	9-3½	9-8	10-0	10-3½	10-6½	52
51	7-10½	8-4½	8-10	9-1½	9-6	9-10	10-1½	10-4	51
50	7-9½	8-3	8-8½	9-0	9-4	9-8	9-11	10-1	50
49	7-8½	8-1½	8-7	8-11	9-3	9-6½	9-10	10-0	49
48	7-7	8-½	8-5½	8-9½	9-1½	9-4	9-9	9-10½	48
47	7-6	7-11	8-4	8-8½	9-½	9-3½	9-7½	9-9	47
46	7-5	7-9½	8-2	8-7	8-11	9-2	9-6½	9-8	46
45	7-3½	7-8	8-½	8-6	8-10	9-½	9-5	9-6½	45
44	7-2½	7-7	7-11	8-5	8-8½	8-11	9-4	9-5	44
43	7-1½	7-5½	7-9½	8-3½	8-7½	8-9½	9-3	9-4	43
42	7-½	7-4	7-8	8-2½	8-6	8-8	9-1	9-2½	42
41	6-11	7-2½	7-6½	8-1	8-4½	8-6½	9-½	9-1	41
40	6-10	7-1½	7-5	8-0	8-3½	8-5	8-11½	9-0	40
39	6-9	7-0	7-3½	7-11	8-2	8-3½	8-10	8-10½	39
38	6-7½	6-10½	7-2	7-9½	8-1	8-2	8-9	8-9	38
37	6-6½	6-9	7-0	7-8½	7-11½	8-½	8-7½	8-8	37
36	6-5½	6-8	6-10½	7-7	7-10½	7-11	8-6½	8-6½	36
35	6-4	6-6½	6-9	7-6	7-9	7-9½	8-5½	8-5	35
34	6-3	6-5	6-7½	7-5	7-7½	7-8	8-4	8-4	34
33	6-2	6-3½	6-6	7-3½	7-6½	7-6½	8-3	8-2	33
32	6-1	6-2½	6-4½	7-2½	7-5	7-5	8-2	8-1	32
31	5-11½	6-1	6-3	7-1	7-4	7-3½	8-½	7-11½	31
30	5-10½	5-11½	6-1½	7-0	7-2½	7-2	7-11½	7-10½	30
29	5-9½	5-10	6-0	6-11	7-1½	7-½	7-10	7-9	29
28	5-8	5-9	5-10½	6-9½	7-0	6-11	7-9	7-7	28
27	5-7	5-7½	5-9	6-8½	6-11	6-10	7-8	7-6½	27
26	5-6	5-6	5-7	6-7	6-9½	6-8½	7-6½	7-5	26
25	5-4½	5-5	5-5½	6-6	6-8	6-7	7-5½	7-3½	25
24	5-3½	5-3½	5-4	6-5	6-7	6-5½	7-4	7-2½	24
23	5-2½	5-2	5-2½	6-3½	6-5½	6-4	7-3	7-1	23
22	5-1½	5-½	5-1	6-2½	6-4½	6-2½	7-2	6-11½	22
21	5-0	4-11½	4-11½	6-1	6-3	6-1	7-½	6-10½	21
20	4-11	4-10	4-10	6-0	6-2	5-11½	6-11½	6-9	20
19	4-10	4-8½	4-8½	5-11	6-½	5-10	6-10½	6-7½	19
18	4-8½	4-7	4-7	5-9½	5-11	5-8½	6-9	6-6½	18
17	4-7½	4-6	4-5	5-8½	5-10	5-7	6-8	6-5	17
16	4-6½	4-4½	4-3½	5-7	5-8½	5-5½	6-6½	6-3½	16
15	4-5	4-3	4-2	5-6	5-7½	5-4	6-5½	6-2	15
14	4-4	4-1½	4-½	5-5	5-6	5-2½	6-4½	6-1	14
13	4-3	4-0	3-11	5-3½	5-5	5-1	6-3	5-11½	13
12	4-2	3-11	3-9½	5-2½	5-3½	4-11½	6-2	5-10½	12
11	4-½	3-9½	3-8	5-1	5-2½	4-10	6-1	5-9	11
10	3-11½	3-8	3-6½	5-0	5-1	4-8½	5-11½	5-7½	10
9	3-10½	3-7	3-5	4-11	4-11½	4-7	5-10½	5-6½	9
8	3-9	3-5½	3-3½	4-9½	4-10½	4-5½	5-9	5-5	8
7	3-8	3-4	3-2	4-8½	4-9	4-4	5-8	5-3½	7
6	3-7	3-2½	3-0	4-7	4-8	4-2½	5-7	5-2	6
5	3-5½	3-1½	2-10½	4-6	4-6½	4-1	5-5½	5-1	5
4	3-4½	3-0	2-9	4-5	4-5	3-11½	5-4½	4-11½	4
3	3-3½	2-10½	2-7½	4-3½	4-4	3-10	5-3	4-10	3
2	3-2½	2-9	2-6	4-1	4-3	3-9	5-2	4-9	2
1	3-1	2-8	2-4½	4-0	4-1½	3-7½	5-1	4-7½	1

Basketball Throw and Catch

Score	Classes								Score
	A	B	C	D	E	F	G	H	
100	..	42	45	..	..	..	56	55	100
99	39	..	..	..	..	..	..	..	99
98	..	..	..	46	48	52	55	..	98
97	..	41	44	..	..	..	..	54	97
96	38	..	..	..	..	..	..	..	96
95	..	..	..	45	..	51	54	53	95
94	..	40	43	..	47	..	..	..	94
93	37	..	..	..	..	..	53	..	93
92	..	..	..	..	..	50	..	52	92
91	36	39	42	44	46	..	..	..	91
90	..	..	..	..	..	..	52	..	90
89	..	..	..	..	..	49	..	51	89
88	35	38	..	43	45	..	51	..	88
87	..	..	41	..	..	48	..	..	87
86	..	..	..	..	..	..	..	50	86
85	34	37	..	42	44	..	50	..	85
84	..	..	40	..	..	47	..	49	84
83	..	..	..	..	..	..	49	..	83
82	33	36	..	41	43	..	..	..	82
81	..	..	39	..	..	46	..	48	81
80	..	..	..	..	..	..	48	..	80
79	32	35	..	..	..	..	..	..	79
78	..	..	38	40	42	45	47	47	78
77	..	..	..	..	..	..	..	..	77
76	31	34	..	..	..	44	..	46	76
75	..	..	37	39	41	..	46	..	75
74	..	33	..	..	..	..	..	..	74
73	30	..	..	..	..	43	45	45	73
72	..	..	36	38	40	..	..	..	72
71	29	32	..	..	..	..	..	..	71
70	..	..	..	..	..	42	44	44	70
69	..	..	35	37	39	..	..	..	69
68	28	31	..	..	..	..	43	43	68
67	..	..	..	..	..	41	..	..	67
66	..	..	34	..	..	..	..	..	66
65	27	30	..	36	38	..	42	42	65
64	..	..	..	..	..	40	..	..	64
63	..	..	33	..	..	..	41	..	63
62	26	29	..	35	37	39	..	41	62
61	..	..	..	..	..	..	..	..	61
60	..	..	32	..	..	..	40	..	60
59	25	28	..	34	36	38	..	40	59
58	..	..	..	..	..	..	39	..	58
57	..	..	31	..	..	..	..	39	57
56	24	27	..	33	35	37	..	..	56
55	..	..	..	..	..	..	38	..	55
54	..	..	..	..	..	..	..	38	54
53	23	26	30	32	34	36	37	..	53
52	..	..	..	..	..	..	..	..	52
51	22	..	..	..	..	35	..	37	51
50	..	25	29	..	..	..	36	..	50
49	..	..	..	31	33	..	..	36	49
48	21	..	..	..	..	34	..	..	48
47	..	24	28	..	..	..	35	..	47
46	..	..	..	30	32	..	..	35	46

BASKETBALL THROW AND CATCH

Score	Classes								Score
	A	B	C	D	E	F	G	H	
45	20	..	..	..	..	33	..	..	45
44	..	23	27	..	31	..	34	..	44
43	..	..	..	29	..	32	..	34	43
42	19	..	..	..	..	..	..	..	42
41	..	22	26	..	30	31	33	33	41
40	..	..	..	28	..	..	..	..	40
39	18	..	..	..	..	..	32	..	39
38	..	21	..	..	29	30	..	32	38
37	..	..	25	..	..	..	..	..	37
36	17	..	..	27	..	..	31	..	36
35	..	20	..	..	28	29	..	31	35
34	..	..	24	..	..	..	..	..	34
33	16	..	..	26	..	28	30	..	33
32	..	19	..	..	27	..	..	30	32
31	15	..	23	..	..	..	..	..	31
30	..	..	..	25	..	27	29	29	30
29	..	18	..	..	26	..	..	..	29
28	14	..	22	..	..	26	..	..	28
27	..	..	..	24	..	..	28	28	27
26	..	17	..	..	25	..	..	..	26
25	13	..	21	..	..	25	..	..	25
24	..	16	..	23	..	..	27	27	24
23	..	..	..	..	24	24	..	..	23
22	12	..	20	..	..	..	..	26	22
21	..	15	..	..	..	..	26	..	21
20	..	..	..	22	23	23	..	..	20
19	11	..	19	..	..	..	..	25	19
18	..	14	..	..	..	22	25	..	18
17	..	..	..	21	22	..	..	..	17
16	10	..	18	..	..	..	..	24	16
15	..	13	..	..	..	21	24	..	15
14	..	..	..	20	21	..	..	23	14
13	9	..	17	..	..	20	..	..	13
12	..	12	..	..	..	..	23	..	12
11	8	..	..	19	20	..	..	22	11
10	..	..	16	..	..	19	..	..	10
9	..	11	..	..	..	..	22	..	9
8	7	..	..	..	19	18	..	21	8
7	..	..	15	18	..	..	..	..	7
6	..	10	..	..	..	..	21	..	6
5	6	..	..	..	18	17	..	20	5
4	..	..	..	17	..	..	..	..	4
3	..	9	14	..	..	16	20	19	3
2	5	..	..	..	17	..	..	..	2
1	..	..	..	16	..	..	..	..	1

A Study to Discover the Relative Numbers of Baseball Games Won at Home and Away from Home in the Major Leagues

By Harold M. Cavins

Assistant Professor of Hygiene, Illinois State Teachers College, Charleston

THIS study is the outgrowth of an attempt to determine, in some field of competitive sports, two things: first, whether in that sport the team playing at home does have any real advantage over its opponent, as indicated by the number of games won; and second, how great that advantage is (if it exists at all) as shown by the same standard.

Major league baseball has been selected as the sport to be studied, for three reasons: first, because of the large number of games played; second, because of the distribution of the games in a year's schedule, with exactly half of each team's games scheduled to be played at home; and third, because accurate records of results of games are obtainable.

It is not within the scope and purpose of this study to attempt to evaluate the various factors that might explain whatever differences are found to exist in a baseball team's tendency to win more (or fewer) of its games at home than away from home.

The crude data from which this study is made are found in the records of completed schedules of the sixteen major league baseball clubs for the years 1932–1937 inclusive. In Spalding's *Official Baseball Guide* or a similar record book can be found the team-by-team records of games won at home and abroad. Records for 1932 appear in the 1933 *Guide*, and so on.

Each major league club schedules 154 games a season, 77 at home and 77 away from home, thus playing 11 games at home with each of its seven league rivals, and 11 games in the home park of each other competing team. Since two teams are participating in each game, the product of four (not eight) and 154 gives the number of games scheduled in a league in one season: 616 games. For both major leagues, the total is 1,232 games; for the six-year period involved in this study, 7,392 games were scheduled. Of this number, 7,332 were actually played, leaving 60 games unplayed.

Table I shows the six-year record of each American League team on the basis of total number of games won, number won at home, and percentage of games won that were won at home. This last item varied

from 52.7 per cent to 57.3 per cent, and in the American League as a whole 54.74 per cent of all games won were won on the grounds of the home club.

Table II presents similar data for the National League. Percentages of games won at home vary from 53.9 per cent to 56.6 per cent with 55.26 per cent representing the National League as a whole. Out of 7,332 games won in both leagues in the six-year period, 4,033 or 55 per cent of them were won at home.

TABLE I

DATA SHOWING NUMBER OF GAMES WON, NUMBER WON AT HOME, AND PERCENTAGE OF GAMES WON AT HOME IN A SIX-YEAR PERIOD, 1932–1937, AMERICAN LEAGUE

Team	Games Won	Won at Home	Won at Home Per Cent
New York	585	320	54.7
Detroit	517	285	55.1
Cleveland	492	282	57.3
Washington	480	253	52.7
Boston	414	233	56.2
Chicago	410	224	54.6
Philadelphia	406	219	53.9
St. Louis	353	186	52.7
Total American League	3657	2002	54.74

TABLE II

DATA SHOWING NUMBER OF GAMES WON, NUMBER WON AT HOME, AND PERCENTAGE OF GAMES WON AT HOME IN A SIX-YEAR PERIOD, 1932–1937, NATIONAL LEAGUE

Team	Games Won	Won at Home	Per Cent Won at Home
Chicago	542	307	56.6
New York	534	286	53.5
St. Louis	513	277	53.9
Pittsburgh	503	278	55.2
Boston	426	232	54.4
Brooklyn	413	234	56.6
Cincinnati	373	211	56.5
Philadelphia	371	206	55.5
National League	3675	2031	55.26
American League	3657	2002	54.74
Both Leagues	7332	4033	55.00

Averages as given in Tables I and II do not give a picture of the year-by-year spread or variation in regard to percentage of games won at home by individual clubs. If that percentage for any one team for any one year be considered one item of data, 96 such items would be included in the six-year records of the sixteen teams.

In 11 of the 96 cases, a team won in a season more than 60 per cent of its total number of games won, at home.

In 74 cases out of 96, a team won more than 50 per cent and less than 60 per cent of its games at home.

In 3 cases out of 93 a team won exactly as many games at home as away.

In 8 cases of the 96, a team won fewer games at home than abroad (less than 50 per cent won at home). The lowest percentage here was 46.0; another of the eight cases was 49.3 and three were 49.4 per cent.

A comparison of first division teams (those that finish the season in first, second, third, or fourth place) with second division teams seemed to indicate in the first five years of this study that the better teams were much less dependent on the "at home" influence than second division clubs, for the respective percentages were 51.70 and 56.01. But 1937 figures showed a different trend. For example, Cleveland, a first division club, won over 60 per cent of its games at home, and the Philadelphia Nationals, a seventh place club, won but 47.5 per cent of its games at home.

Table III presents these data for the full six-year period.

TABLE III

COMPARISON OF FIRST DIVISION AND SECOND DIVISION TEAMS IN NUMBER OF GAMES WON, IN NUMBER WON AT HOME, AND IN PERCENTAGE OF GAMES WON AT HOME, 1932–1937

Teams of:	Games Won	Won at Home	Per Cent Won at Home
First Division	4243	2314	54.53
Second Division	3089	1719	55.64
All Teams	7332	4033	55.00

CONCLUSIONS

1. Some factor or factors favorable to victory of the team playing in its own city and its own park seem to exist in professional baseball, for major league teams won, in a period covering six consecutive years and more than 7,000 games, eleven games at home for every nine won away from home.

2. The evidence for the existence of such a factor or factors is very slightly greater in the National League than in the American League.

3. First division teams seem slightly more independent of this influence than do second division teams.

Studies in Measuring Basketball Playing Ability of College Women

By Ruth B. Glassow, Valarie Colvin, and
Marguerite M. Schwarz
University of Wisconsin

INTRODUCTION

THE need for objective measurement in physical education is recognized by the profession today. There are, however, few published tests of athletic skills which give evidence of scientific procedures in establishing the "goodness" of test items and of tests as a whole.

A survey of the literature on basketball testing shows that the most complete and comprehensive study has been done by Young and Moser[1] at the University of California. This study contains not only a battery of tests, but also a brief survey of past testing in basketball.

Since publication of the Young and Moser study, a further article "Knowledge and Achievement Tests in Girl's Basketball on Senior High School Level," [2] has appeared. The author of this study states that the reliability and validity of the tests were established, but does not include evidence. Of interest in this study is the statement that a basket-shooting test of 10 trials was reliable. This fact is so unusual that the work proving the reliability should be published.

The instructor of basketball who is looking for a test must start with the Young and Moser battery as the one basketball test at the present time which presents evidence of scientific procedures in determining the merits of the battery.

The problem at the University of Wisconsin was to find an objective measure of basketball playing ability to use as a method of grading in college classes. Examination of the Young and Moser battery led the writers to believe that these tests must be accepted with qualifications.

EVALUATION OF THE YOUNG AND MOSER BATTERY

Five test elements are included in the Young and Moser battery. The reliability coefficients given for these are .98, .78, .67, and .47. The fifth test element is Edgren's Ball Handling Test, and the authors state, "The reliability of this test was not checked, but from previous experi-

[1] G. Young and H. Moser, "A Short Battery of Tests to Measure Playing Ability in Women's Basketball," Research Quarterly 5:2 (May, 1934) 3.

[2] H. Schwartz, "Knowledge and Achievement Tests in Girls' Basketball on the Senior High School Level," Research Quarterly, 8:1 (March, 1937) 143.

mentation it was assumed to be satisfactory for this study." Edgren's report[3] makes no statement regarding the reliability of the Ball Handling test and, while the type of the test would lead one to believe that it is likely to be reliable, there is no assurance that ten throws for one trial or that one trial of ten throws will prove to be a reliable measure.

Of the reliability coefficients which are given, two, .47 (Moving Target) and .67 (Bounce and Shoot), are too low to be used for individual grading of pupils. The authors quote Garrett[4] "an r of $\pm.40$ to $\pm.70$ is substantial." In making this statement, Garrett is discussing the relationship between two tests. Regarding reliability, the same reference (p. 269) states, "To be a reliable measure of capacity, a mental or physical test should—generally speaking—have a minimum reliability coefficient of at least .80."

Of the five elements in this battery of tests, only one may be used with confidence in its reliability—Free Jump (.98). Another, Speed Pass (.78), has possibilities; perhaps three trials instead of two would make it an acceptable test. Bounce and Shoot is questionable; Moving Target lacks reliability, and the status of Edgren's test is unknown.

Validity studies based on tests which are not reliable can have little value. Yet if we accept the Young and Moser battery as reliable, the statistical work which these authors have done on validity could be carried further with profit. The work as published gives zero-order correlations only for validity. Using the figures which are given, partial coefficients calculated at Wisconsin were found to be:

Test	Zero order (as given by Young and Moser)	Partial Coefficient (Computed by authors of this article)
Edgren Ball Handling	$r12 = .63$	$r12.3456 = .037$
Speed Pass	$r13 = .60$	$r13.2456 = .38$
Moving Target	$r14 = .58$	$r14.2356 = .36$
Free Jump	$r15 = .56$	$r15.2346 = .43$
Bounce and Shoot	$r16 = .51$	$r16.2345 = .33$

These figures indicate that the Young and Moser battery would be fully as valuable if the Edgren Ball Handling Test were omitted.

The instructor who wishes tests to grade pupil achievement or progress should remember that the Free Jump test is scored on stature as well as on skill. The test as set up makes no allowance for height. The tall girl may have an advantage due to growth and not to skill. If the test is to be used to classify students, this feature may not be ob-

[3] H. D. Edgren, "An Experiment in the Testing of Ability and Progress in Basketball," RESEARCH QUARTERLY, 3:2 (March, 1932) 159.

[4] H. D. Garrett, "Statistics in Psychology and Education," Green and Company, (New York: Longmans, Green and Co.) 298.

jectionable. If it is to be used for grading, there is at least justification for the argument that skill rather than stature should be measured by the test. The commonly used Jump and Reach is much the same test, but the measure is based upon ability to jump rather than on height.

In the opinion of the authors of this article, Young and Moser's work contains only one element which can, without further study, be used with confidence—the Speed Pass. Bounce and Shoot and the Free Jump give indications of being valuable test elements for basketball.

The present study at the University of Wisconsin attempts to discover if possible, an objective measure of basketball playing ability to be used as a method of grading in college classes.

From the results of previous studies, the five items were chosen as the elements contributing to playing ability in basketball. The tests for these elements were called:

1. Bounce and Shoot
2. Zone Toss
3. Wall Speed
4. Jump and Reach
5. Pivot and Shoot

A complete description of the tests appears at the end of this article.

SCORING PLAN FOR BOUNCE AND SHOOT AND FOR PIVOT AND SHOOT

In these tests, the authors wished to devise a score which would recognize both speed and accuracy. Accuracy alone was scored by the total points given for the ten trials—two points for each basket made, one point for each ball which hit the rim but did not go through the basket. Speed alone was scored in terms of seconds (measured to the nearest one-tenth) needed to perform the ten trials.

These scores for accuracy and speed were scaled in terms of distance from the mean measured by the standard deviation of each distribution. The mean, plus the minus one-quarter of a sigma, was scored 9, and each one-half sigma above was scored an additional point. Distances below the mean were scored one point less for each one-half sigma.

Minus ½ Sigma	Minus ½ Sigma	Minus ¼ Sigma	Mean	Plus ¼ Sigma	Plus ½ Sigma	Plus ½ Sigma
7	8			9	10	11

This plan scored accuracy and speed in like units, and these were then combined by multiplying the two scores and the product was the score for the Bounce and Shoot or the Pivot and Shoot test.

Fouls which occurred were penalized by adding one second for each foul to the speed score before it was rescaled in terms of the standard deviation. The penalty was determined on the basis of the sigma scoring plan. The standard deviation for the speed distribution was 5.6. The half standard sigma is 2.8 and three fouls would change the speed score by one point. This seemed a justifiable penalty, since

frequent fouling was penalized. So few fouls occurred on the Pivot and Shoot test that the scoring was not changed in this test. The penalty for fouls was applied only to the Bounce and Shoot test.

An example of this scoring plan follows:

		Accuracy	Score	Fouls
	Time	Goals	Rims	
Raw Scores	65 sec.	3 x2 6	7 x1 7	3
		Tot. = 13		

From the sigma score sheets we would find that a time score of 68 seconds (65 seconds plus 3 seconds for the three fouls) gives a score of 6. An accuracy score of 13 transposed into the sigma scores would be 6. Multiplying these together we get a final score of 36.

	Time	Accuracy	Score for the Test
Score Values	6	6	36

RELIABILITY OF THE TEST ITEMS

Previous studies have shown Jump and Reach and Wall Speed to be reliable tests. Jump and Reach had been found at the University of Oregon[5] to have a reliability coefficient of .87 ± .01, 123 subjects. Previous studies at Wisconsin on the Wall Speed test had resulted in a reliability coefficient of .89. Jump and Reach and the Wall Speed were accepted as reliable tests.

The reliability of the remaining three tests was checked by comparing the scores made by fifty-one major students in physical education with the scores made on a repetition of the tests. All tests were given within a two weeks period.

Results:

Test	r	P. Er	No. Tested
Bounce and Shoot	.815	± .032	51
Pivot and Shoot	.824	± .03	51
Zone Toss	.743	± .042	52

Garrett[6] states that .8 is an acceptable reliability. One of the test items is below this standard (Zone Toss), but was retained in the validity studies since it falls only a short distance below the .8.

VALIDITY OF THE TEST ITEMS

Validity of the tests was checked by the relationship found between

[5] Florence D. Alden, M. Horton, G. M. Caldwell, "A Motor Ability Test for University Women for the Classification of Entering Students into Homogenous Groups." RESEARCH QUARTERLY, 3:1 (March, 1932) 101.

[6] Garrett, *op. cit.*

each test item and a subjective ranking of playing ability. The experimental group was composed of twenty-seven sophomores, eleven juniors, and sixteen senior major students in physical education, making a total of fifty-four. These major students had been in basketball classes and had participated in intramural games with each other from one to four seasons.

In addition, the sophomores and juniors were enrolled in a basketball technique course which included three hours of practical work each week. These students were asked to rank the members of their own class into five groups according to playing ability. They were to select the best player in the class, the poorest, and an average player, and to name a student who ranked between the poorest and the average. Taking these five as standards, the remainder of the class was grouped in five divisions according to playing ability. If not sure of an individual's ability, it was not necessary to rank her.

This rating according to playing ability was done before the tests were administered and was done during the hour in which the ranking was explained so that there was no opportunity to discuss the ranking with classmates. These rankings were translated into a numerical score by assigning a value of 5, 4, 3, 2, 1 to each of the five groups; five being best. The scores given to each student were then totaled and divided by the number of times each student had been ranked. For example, No. 3 has scores 2, 2, 3, 3, 3, 3, 2, 2, 2, 2, 4, 2, 2. Total = 32.

$$\text{Average} = \frac{32}{13} = 2.46.$$

The average was used as the best available measure of each student's playing ability. (Note: This method places the sophomore class on the same numerical basis as the two upper classes. Since the additional training of the junior and senior years undoubtedly increases playing ability, the sophomore scores were lowered by subtracting .5 from each average. The standard deviation of the scores for playing ability was found to be .93 and subtracting .5 from each score means that each sophomore was moved down approximately half of a standard deviation.)

The instructor in charge of basketball, who is a national judge of the Women's Official Rating Committee, also rated each student. A comparison of her judgment with the scores of playing ability based on the student's ratings showed that the average variance between her ratings and that given by the class was .15. The greatest single variance was .43. This is less than one-half of the standard deviation of the scores.

On this basis we felt justified in using the students' rankings as a measure of ability to play basketball.

Validity Study:

TABLE OF INTERCORRELATIONS

	Bounce and Shoot	Zone Toss	Wall Speed	Jump and Reach	Pivot and Shoot
Bounce and Shoot					
Zone Toss	—.47				
Wall Speed	.35	—.356			
Jump and Reach	.31	—.34	.42		
Pivot and Shoot	.75	—.307	.32	.12	
Ratings	.556	—.455	.442	.285	.43

The figures suggest certain observations. Jumping as an isolated skill has very little value in measuring playing ability as is seen by correlation .285 between the Jump and Reach test and ratings. Tests which combine skills of handling the ball while the body is in motion have higher correlations than do stationary tests. Examples which illustrate this are Bounce and Shoot, Zone Toss, and Pivot and Shoot being higher than the other stationary tests. This would tend to indicate that the more nearly we can make our tests approach the game situation the better chance we have of securing a battery that will measure playing ability.

Partial correlations show that the individual tests contribute to the battery in the following order: first, Bounce and Shoot; second, Wall Speed; third, Zone Toss; fourth, Pivot and Shoot. Jump and Reach contributes nothing.

Partial *r*'s				Zero Order *r*'s		
12.3456	=	.24	(Bounce and Shoot)	12	=	.55
13.2456	=	—.22	(Zone Toss)	13	=	.45
14.2356	=	.23	(Wall Speed)	14	=	.42
15.2346	=	.0006	(Jump and Reach)	15	=	.28
16.2345	=	.19	(Pivot and Shoot)	16	=	.43

(NOTE: The minus correlation for Zone Toss is due to the score in time. The lower the numerical score in time (the faster the subject) the higher is the ranking of the subject.)

1 = ranking		4 =	Wall Speed
2 =	Bounce and Shoot	5 =	Jump and Reach
3 =	Zone Toss	6 =	Pivot and Shoot

Since Jump and Reach contributes so little, it was dropped from all but one of the calculations of multiple correlations. The multiple R's were found to be:

$R_{1.23456} = .66$ $R_{1.24} = .60$
$R_{1.234} = .66$ $R_{1.64} = .43$
$R_{1.634} = .64$ $R_{1.63} = .56$
$R_{1.23} = .61$ $R_{1.34} = .53$

These figures show:

1. That Bounce and Shoot, Zone Toss, and Wall Speed combined are as valid a battery as are the five tests.

2. That in all combinations of Bounce and Shoot with any one test, the validity is slightly better than is that of Pivot and Shoot combined with the same test.

3. That Pivot and Shoot and Bounce and Shoot may be used as measuring the same skills. (See also the intercorrelation of .75 between the two tests.)

4. That two batteries (2, 3 and 4; 6, 3 and 4) have a high degree of validity. (.7 is considered an acceptable validity.)

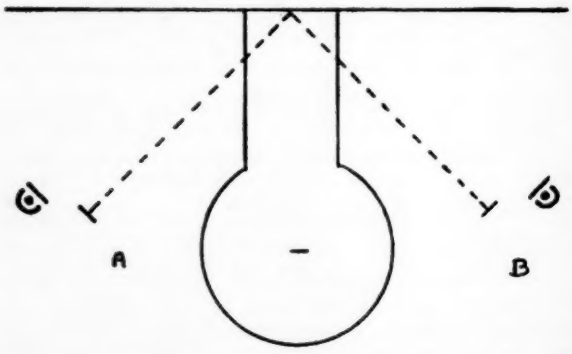
5. Additional study should determine whether skill tests or tests of other elements could be combined with these batteries to increase the validity.

DESCRIPTION OF TESTS

Bounce and Shoot.—

1. Personnel—timer, scorer, two ball catchers (subjects may catch for each other).

2. Equipment—two chairs, two basketballs, stop-watch, regulation backboard and rim, floor diagram as shown in Fig. 1.



On either side of the basket at an angle of 45°, an 18-foot dotted line is drawn from the center of the end line. Perpendicular to the 18-foot lines, 24-inch lines are added. Starting from a point 1 foot behind and 30 inches to the outside of the 18-foot lines, additional lines 18 inches long are drawn. On each of the 18-inch lines, a chair with a ball is placed.

A ball catcher stands behind each chair and replaces the ball on the chair after each pass from the subject.

3. Procedure—The subject starts on the 24-inch line at the *B* side of the basket. On the signal "Go" from the timer, the subject picks up the ball from the chair, bounces, shoots, recovers the rebound and passes the ball back to the catcher at *B*. She runs immediately to *A*, picks up the ball from the chair and repeats the bounce, etc., passing the recovered shot back to the catcher at *A*. (This procedure is repeated, alternating five times on each side, making a total of ten shots.) Each bounce must start from behind the 24-inch line on the proper side.

The timer keeps the time from the signal "Go," and notes and records all fouls. The scorer records the points made on the basket shots, keeps a record of the number of shots and notifies the timer on the ninth shot.

4. Fouls—The fouls are: running with the ball; double bounce; failure to start from behind the 24-inch line.

5. Scoring—The score combines time and accuracy.

a.) The time to the nearest tenth of a second from the signal "Go" until the subject has caught the ball after the tenth shot at the basket.

b.) The accuracy score for shooting on the following basis: two points for baskets made, one point for hitting the rim but missing the basket, nothing for missing the basket and the rim.

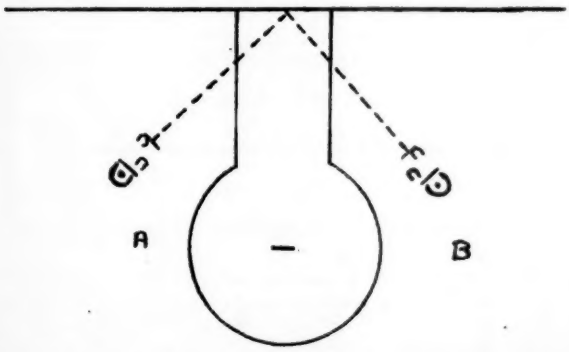
c.) The addition of one second to the time score for any foul.

6. Final Score—The time and accuracy scores are combined for each trial as described previously. The subject's final score is the sum of the best two out of three complete trials, given at least two minutes apart.

Pivot and Shoot.—

1. Personnel—Same as for Bounce and Shoot.

2. Equipment—Same as the Bounce and Shoot with the exception of the floor diagram, as shown in Fig. 2.



On either side of the basket at an angle of 45°, a 12-foot dotted line is drawn from the center of the end line. Perpendicular to the 12-foot lines, additional 24-inch lines are drawn. Two feet beyond the 24-inch lines, additional lines 18 inches long are drawn. On each of the 18-inch lines a chair with a ball is placed. The pivot is a rear pivot toward the inside of the court. A heel mark for the rear foot is drawn on the 24-inch line, while the heel mark for the front foot is marked 12 inches beyond the 24-inch line.

3. Procedure—The subject stands on the *B* side of the basket, her heels on the marks. On the signal "Go," she picks up the ball from the chair, does a rear pivot and shoots immediately. She recovers the rebound, passes the ball to the catcher

at *B* and runs to *A*. Following the pivot, shot, and pass back to *A* she runs to *B*. This procedure is repeated, alternating five times on each side, making a total of ten shots.

The timer keeps the time from the signal "Go" and records the fouls. The scorer records the points made on the basket shots, keeps a record of the number of shots, and notifies the timer on the ninth shot.

4. Fouls—The fouls are failure to start upon the 24-inch line and lifting both feet before the ball is thrown.

5. Scoring—A combination of accuracy and time:

a.) The time to the nearest tenth of a second from the signal "Go" until the subject has caught the ball after the tenth shot at the basket.

b.) The accuracy score for shooting on the following basis: two points for baskets made, one point for hitting the rim but missing the basket, nothing for missing the basket and the rim.

c.) One second was to be added to the time score for each foul, but no fouls occurred to make the penalty necessary.

6. Final Score—The time and accuracy scores are combined for each trial as in the Bounce and Shoot. The subject's final score is the sum of the best two out of three complete trials, given at least two minutes apart.

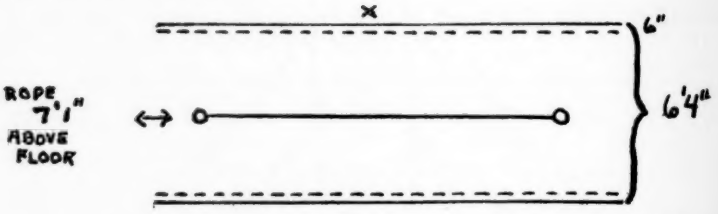
Jump and Reach.—The test used was that described by Cozens, Trieb, and Neilson in *Physical Education Achievement Scales*. For this test the best of three trials was taken as the subject's final score.

Wall Speed.—The test used was that of Young and Moser mentioned earlier in this article.

Zone Toss.—

1. Personnel—Timer.

2. Equipment—Basketball, stop-watch, jumping standards and apparatus, and floor plan as shown in Fig. 3.



A zone 6 feet 4 inches wide is marked on the floor. An inside dotted line, 6 inches from each boundary line, inside measurements is added. Bisecting the zone, jumping standards are placed 10 feet apart. A rope is tied between the standards 7 feet 1 inch from the floor.

3. Procedure—The subject stands with the ball in her hands, facing the zone. On the signal "Go" from the timer, she tosses the ball over the rope and retrieves it on the other side. The same procedure is repeated with the ball being tossed from each side alternately until the subject has caught the ball following the tenth toss. The subject is told that each toss must be made from outside the zone boundaries, but she is not penalized unless her foot crosses the 6-inch line.

4. Fouls—The fouls are tossing the ball under the rope, or stepping over the 6-inch line before the ball is tossed.

5. Scoring—The time for 10 tosses is taken. One second is added for each foul.

6. Final Score—The final score is the sum of the best 4 out of 6 trials.

Basketball: Essential Differences Between the Two-Court and the Three-Court Game for Girls of Different Age Levels

By Marjorie E. Fish

Supervisor of Women Physical Education Majors
University of Southern California

SOME months ago I started to collect data comparing the two- and three-court game of basketball. I interviewed high school teachers, college instructors, major students, and players, and reviewed articles which had been written on the subject. This information I have compiled in outline form as follows:

ADVANTAGES OF THE TWO-COURT GAME

1. More variety of play and therefore more interesting and satisfying to players.
2. More skills, technique, and team plays are possible and essential.
3. A feeling of more freedom in playing since players cover more area.
4. A greater premium is placed on team work.
5. Centers have a greater responsibility and more opportunity to play.
6. Three players can shoot. This helps to make the game more interesting from the player and spectator's point of view.
7. It is a speedier game than three court.
8. If the court is very small, play may still be more open and the game more stimulating.

DISADVANTAGES OF THE TWO-COURT GAME

1. If played on a large court, play may be too strenuous for some.
2. There is a tendency to bunch under the basket, thus making the play very sloppy.
3. Forwards are often lost in a zone defense.
4. A weak forward may be left out of play considerably without the team being effected.

ADVANTAGES OF THE THREE-COURT GAME

1. Less strenuous for players because of the smaller playing area.
2. Team work; that is, every member of the team participating most of the time is essential.
3. There is a place for the short, speedy girl as side center.

A paper presented before the Women's Athletic Section of the Southwest District Association Convention, April 1938, Salt Lake City.

DISADVANTAGES OF THE THREE-COURT GAME

1. Many courts are small and three divisions make each area too limited for interesting play, especially for the advanced player.
2. Team plays and tactics are extremely limited.
3. Not as much challenge to originate plays and develop team work.
4. There is a feeling of restraint due to the small area to which each player is confined.

A STUDY OF THE TWO- AND THREE-COURT GAMES

Last year my technique class in basketball at the State Teachers College in Trenton, New Jersey, made a short study to discover certain elements in the two- and three-court games and to measure these in an objective way. This study is far from being scientifically accurate due to (1) the small number of cases—35; (2) the fact that it was made in only one section of the country; (3) the uncontrollable nature of replies; and (4) the interpretation of results.

However, the study is valuable in as much as it (1) gives a bird's eye view of the two- and three-court games; (2) provides cues for further investigation; (3) contributes objective data which may be used as a starting point and which may help to clarify our thinking regarding the two- and three-court games.

The number of studies sent out were 90 and the number of returns 35. In this group 24 were reports on high school games and 11 were college games.

Of the high school returns (24), 8 were on the two-court game and 16 on the three-court.

The college returns (11) were 5 two-court and 6 three-court.

All the high school games were intramural; 9 of the college games were intramural and 2 were varsity.

The elements tested in this study were: interruptions during the game; actual playing time; fouls, number and type; tie balls; shots, short, long, and free throw, and who recovers shots not made; out-of-bounds balls.

The conclusions for the high school games follow: There were 18 three-court games recorded and 8 two-court.

1. *Interruptions During the Game.*—The number of interruptions in both games is 73; to be exact, 73.16 in the two-court and 73.5 in the three-court.

2. *The Actual Playing Time.*—In the three-court game, actual playing time was longer, 71.6 per cent of the total time as compared with 58 per cent in the two-court game. (Per cent was taken because all the games recorded were not the official thirty-two minutes.)

3. *Fouls.*—The studies gave the following returns:

a) More fouls occurred in the two-court game than the three-court; 11.6 vs. 9.9.

b) In two-court there was an average of 8.6 personal fouls vs. 5.4 in three-court, and three technical in two-court vs. 3.18 in three-court.

c) Pushing was the foul most frequently occurring in both games, but more often in two-court; 44 per cent as opposed to 34.8 per cent in three-court.

4. *Tie Balls.*—There were more tie balls in three-court than the two-court game; 45.53 vs. 27.91, or 50 per cent more tie balls in three-court than two-court.

5. *Shots.*—These were classified into the commonly designated divisions of free throws, short shots, and long shots.

a) Free throws. (1) Since there were more fouls committed in the two-court game, it naturally follows that there would be more free throws in the two-court game; 12.2 vs. 9.4. (2) The percentage of free shots made was exactly the same in both two-court and three-court game, namely, 37 per cent.

b) Short shots. (1) There were more short shots taken in two-court than in three-court; 40 vs. 34.4, but the percentage of shots made was higher in three-court than two-court: 41 per cent vs. 37 per cent.

c) Long shots. (1) More long shots were attempted in three-court than two-court; 25.2 vs. 17.4. (2) The percentage of long shots made was 22 per cent in two-court and 17 per cent in three-court.

6. *Recovering of Ball after Shooting.*—The per cent of times the guard recovered the ball was higher than that of the forward, being 54 per cent; exactly the same for both two-court and three-court.

7. *Out-of-Bounds Balls.*—There were more out-of-bounds balls in three-court than in two-court; 57.7 vs. 38.4, or 50 per cent more out-of-bounds balls in the three-court game.

THE COLLEGE FINDINGS

The college findings were quite different, which one might expect would be due to the added playing experience of members of the team and the fact that the two-court game was more familiar to them.

These results are from 11 games, 4 three-court and 5 two-court intramurals and 2 three-court varsity games.

1. *Interruptions during the Game.*—There were over twice as many interruptions in the three-court as in the two-court (94 vs. 42.4), and fewer interruptions in the varsity games than in the intramurals.

2. *Actual Playing Time.*—The actual playing time is slightly higher in two-court intramural than three-court, 54 per cent vs. 53 per cent, while in varsity games actual playing time is 65 per cent.

3. *Fouls, Personal.*—There are more personal fouls in varsity than in intramural, (9.5 vs. 7.5).

Fouls occur more often in two-court intramural than three-court intramural (8.6 vs. 6.5).

The most fouls occur during the last quarter in varsity competition and the first quarter in intramurals.

Charging was called more often in varsity (36 per cent of total personal fouls) and occurs more often in intramural three-court than the two-court (40 per cent vs. 22 per cent).

Pushing occurred more frequently in two-court intramural than three-court (40 per cent vs. 31 per cent).

The order of frequency of personal fouls is pushing and charging two-court game, then tagging for two- and three-court intramural, obstruction is next on two-court, while blocking is next on three-court.

Fouls, Technical.—There are more technical fouls called on varsity than intramural (6.5 vs. 2.1 and 1.75).

4. *Tie Balls.*—There are more tie balls in varsity intramurals; 31 vs. 13 intramural two-court and 11.75 intramural three-court.

The centers jump more often in varsity than intramural (20 vs. 18), but there are more jumps in the center area in two-court (19.8) than three-court (16.25).

5. *Shots.*—The previous classification was again followed.

a) Free throws. (1) The number of free throws in the varsity game is larger than the intramural, 17 vs. 10.7. The number in intramural two-court is approximately the same as the three-court (10.6 vs. 10.7). (2) the per cent of free throws made is higher in varsity (35 per cent) than either three-court intramural (33 per cent or two-court intramural (30 per cent).

b) Short shots. (1) More short shots were taken in varsity (53) than either two-court intramural (48) or three-court intramural (35.7). (2) The largest number of short shots made were in the three-court intramural with 34 per cent. There were more made in two-court, 30 per cent than varsity, 25 per cent.

c) Long shots. (1) There were over twice as many long shots taken in varsity competition than in either the two- or three-court intramural, 27.5 vs. 11.5, and more in three-court than two-court (12 to 11). (2) The number of long shots made was greatest in the two-court intramural (42 per cent) with varsity next (20 per cent) and the three-court intramural last with 17 per cent.

6. *Recovering Shot Ball.*—The guard recovered ball 68 per cent of the time in three-court intramural, while only 36 per cent of the time in two-court intramural, and 56 per cent of the time in varsity.

The forward recovered the ball more often in two-court intramural

(64 per cent) while the varsity was 44 per cent and the three-court intramural 32 per cent.

7. *Out of Bounds.*—The ball goes out of bounds more in varsity competition, 73 vs. 35.5, and more in three-court intramural, 41.25, than two-court, 30.15.

GENERAL CONCLUSIONS FOR THE COLLEGE AND HIGH SCHOOL GAME

1. Only a little more than one-half of the time of the game was spent in actual playing in intramural games in college while 65 per cent was used in high school play; varsity playing time in college was the same as intramurals in high school, namely 65 per cent.

2. Interruptions during the game in three-court are more frequent in college intramural than high school, but greatest in three-court varsity competition. The number is approximately the same for three-court and two-court high school intramurals. On the whole three-court has almost twice as many interruptions in its game than two-court.

These factors suggest that in the high school game there is not much difference between the strenuousness of the two-and three-court games, since both seem to have the same number of interruptions. Actual playing time is greater in three-court than two-court in high school, but approximately the same in the college game.

I wonder if we have not been emphasizing without scientific evidence the fact that the two-court game is too strenuous for the average high school girl if played on a large court. We permit and advocate hockey, soccer, and speedball for girls of this age, and these games require the girl to cover 85 yards and the actual playing time of game is usually longer, 40 minutes as against 32 minutes (maximum).

A prominent New York cardiologist says one cannot injure a *good* heart through exercise, regardless of the amount and strenuousness of it. He claims the body has a safety valve which impels the individual to stop before the danger point is reached. This is true only of the good heart. Our problem is then one of detecting the injured heart and preventing overwork in these cases. Then, too, the adolescent period is one in which individuals are undergoing many changes; physical, emotional, mental, and social. The physical changes are made through exercise of the big muscles of the body, and the body demands strenuous activities to obtain best results.

Since the greatest objection to the two-court game seems to be the question of the amount of area the players have to cover, it appears that the above would tend to offset this.

I had a letter from Miss Meissner, our National Basketball Chairman, and in it she stated that some requests are being made to have the two-court game be made the only official game for college players. She

also said that the two-court game is growing in popularity in all sections of the country.

It seems to me that our problem is to experiment and try to discover through scientific means which game is best adapted to our needs. Perhaps the three-court game might be best for high school girls, keeping the two-court game for our college girl.

Food Habits of Sixth- and Seventh-Grade Pupils in Ten Elementary Schools of Chicago

By Agnes B. Peterson

Elizabeth McCormick Memorial Fund, Chicago

IN THE fall of 1936 an investigation of the food habits of 1,624 boys and girls in the sixth and seventh grades was made in ten elementary schools in Chicago. The schools selected for the study had undertaken intensive health education programs with the cooperation of the Elizabeth McCormick Memorial Fund.

Most of the pupils were at least second or third generation American with diverse national origins. The general economic level of each school district was estimated from interviews with principals and teachers and from observation of the children and neighborhood conditions. In the school which was considered the median of the group it was learned from the Social Service Exchange that 54 per cent of the total number of families represented were known to a relief or welfare agency. In two or three schools many of the children were from fairly well-to-do homes, but most of the families of the study undoubtedly belonged to the low-income groups.

PURPOSES OF THE STUDY

The dietary study was undertaken with two purposes in mind. The first was to determine the extent to which minimum food standards are met by families of low economic level in a large city. The second was to interest both teachers and pupils in food habits before undertaking a study of foods and meal planning. In the health teaching which had been carried on up to this time, the subject of food had in general been avoided. Many of the teachers were hesitant to discuss foods with the children because they felt that when the family income was low very little choice in the selection of foods was possible. However, the nutritionists who planned the study were convinced that the results would emphasize the need for education in regard to choice of foods at all economic levels and especially in families in which money for food is limited in amount and must be spent to the best advantage.

Information concerning food consumption was obtained by having the pupils keep daily records of their food intake for a week. Individual records in mimeographed form provided spaces for the kinds of food and the amount of each eaten at the regular morning, noon, and evening meals, and at other times such as recess, after school, and evening. The project was introduced to the pupils by two nutritionists

on the staff of the Elizabeth McCormick Memorial Fund. Interest in the food habits of a large number of boys and girls, rather than of the individual, was stressed. It was hoped, by this means, to avoid self-consciousness and embarrassment on the part of the pupils in reporting their actual food habits. The pupils were told that they need not sign their names to the records unless they wished. Sample food lists were written on the blackboard to demonstrate how the records should be kept. The importance of detail was emphasized, such as the kind of bread or breakfast cereal, the kind of soup, pudding, or salad, whether the bread was eaten plain or with butter, oleomargarine, or jam, and whether milk, cream, or sugar was eaten on breakfast cereals. Amounts of foods eaten were indicated by the number of servings which were described as large, medium, or small.

On the whole the teachers and nutritionists considered the records reasonably accurate as to the kinds of food eaten. The reports on sizes of servings represented individual judgments and were far from reliable records of actual amounts but they are believed to give a fair estimate of the quantity of food usually eaten by the boys and girls in the grades surveyed.

Many of the weekly records were found to be incomplete for one or more days, chiefly as the result of irregular school attendance. In order to include as large a number of individuals as possible, it was decided to compute the daily food intake for each pupil by taking the average of the records for two successive days rather than for the entire week. The records were staggered throughout the week so that all days of the week were equally represented. For example, the records of one pupil for Sunday and Monday were tabulated; of the next pupil, for Monday and Tuesday; and of the next, Tuesday and Wednesday, etc. If any records were incomplete for the selected days, the records for the nearest two consecutive days were considered. For the group as a whole, this method should present a reasonably accurate picture of the week's dietary.

To evaluate the day's meals a standard was set up of the minimum daily requirements of foods which are especially important in safeguarding the dietary. A minimum standard was used because of the generally low economic level of many of the homes. It included

Milk—1 pint
Vegetables and fruits, including potato—3 servings
Meat, fish, eggs, dried beans or peas—1 serving

The standard does not necessarily represent an adequate dietary, but failure to meet these low requirements would almost certainly indicate a shortage of some of the food elements essential for health and growth.

One serving daily of whole-grain bread or cereal was originally included in the standard. In tabulating, whenever the kind was not

specified, the bread or cereal was assumed to be a refined product. This assumption was necessary in so many cases that the results, which showed that 91 per cent of the entire group failed to have a whole-grain cereal daily, are not reliable.

Milk used in foods was not considered in determining the daily milk intake except in cases where it formed the chief ingredient as in cream soup and milk pudding. On the other hand, a cup or glass of milk in the record was credited with being one-half pint. Cheese, whenever it was included in the food lists, was translated into its milk equivalent. Any three servings of fruits and vegetables were said to meet the standard, as, for example, three servings of one or of different vegetables or fruits or any combination of the two.

SUMMARY OF FOOD CONSUMPTION

A summary of the food consumption of the entire group of 1,624 boys and girls with respect to the different foods listed in the standard shows that 73 per cent had, on the average, a pint or more of milk daily, 43 per cent had three or more servings of vegetables and fruits, and 90 per cent had at least one serving of meat or other protein food.

The milk record, which is comparatively good, undoubtedly shows the effect of education. In recent years milk has been given great emphasis both in teaching and in advertising, and many schools, including some of those taking part in the study, have served mid-morning milk regularly. Even so, more than one-fourth of these boys and girls, according to their own records, were not having the minimum amount of milk believed necessary for good growth and health.

The vegetable and fruit consumption was markedly below the standard set up. Less than one-half of the group, 43 per cent, were getting the minimum requirements of these essential foods. On the other hand, the records showed that a small percentage of the boys and girls were having vegetables and fruits in amounts far in excess of the standard. A study of the records indicated that many pupils had little variety in the kinds of vegetables and fruits eaten; for example, in some families potato was the only kind reported during the week.

A large proportion of the pupils, 90 per cent, met the standard for meat and other protein foods. In most cases the proteins of better quality—meat, fish, and eggs—were found to be used rather than dried beans and peas, and it was not uncommon to find them served more than once a day even among children whose dietaries were deficient in milk and vegetables.

The ten schools showed a wide variation in the degree to which they met the standard for the different foods. The range is shown in Table I.

TABLE I

PERCENTAGE OF PUPILS MEETING OR EXCEEDING THE MINIMUM FOOD STANDARDS

	School having highest rating	School having median rating	School having lowest rating
Milk	88	75	53
Vegetables and fruit	72	43	31
Meat and other protein foods	96	90	85

Between-meal eating was an almost universal practice among the group. Irregular eating occurred from two or three times a week to many times a day and varied greatly in frequency as well as in amount among the different children and also from day to day for the same child. Many kinds of foods were reported, but sweet foods, including candy, cake, cookies, and pie, predominated. Bread and butter and fruit were mentioned frequently in the records. It was especially fortunate in some cases that fruits were eaten between meals as a number of children reported little or no fruits or vegetables at the regular meal time.

The number of pupils whose average daily dietaries met or exceeded the total standard was found to be extremely low. Less than one-third of the group, 31 per cent, were having regularly at least the minimum amounts of milk, vegetables and fruit, meats and other protein foods. The results, by schools, are shown in Figure 1.

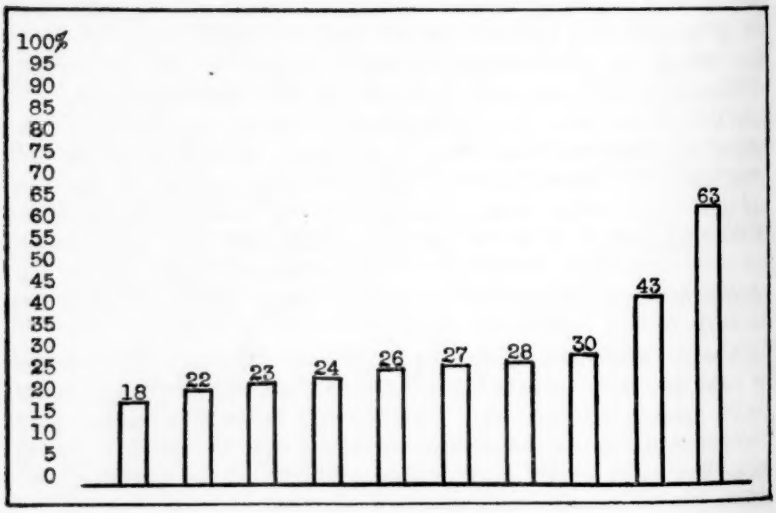


FIGURE 1

PERCENTAGE OF PUPILS IN TEN SCHOOLS MEETING OR EXCEEDING MINIMAL REQUIREMENTS FOR MILK, VEGETABLES AND FRUITS, AND MEATS OR OTHER PROTEIN FOODS

It will be seen that the number of children who met or exceeded the standard ranged from 18 per cent at one extreme, or less than one-fifth of the pupils, to 63 per cent, or about three-fifths of the pupils, at the other extreme. This serious lack of essential foods in the dietaries of a large number of boys and girls in a big city is undoubtedly due in part to poverty. In most cases, however, more intelligent meal planning and a better distribution of the same amount of food money would result in a great improvement in food habits and would often mean an adequate rather than an inadequate food intake. The records give many evidences of the need for more widespread information regarding food values and meal planning. To mention a few examples: the amount of money spent for meats and sweets was usually far out of proportion to the amount spent for milk, vegetables, and fruits; sweet rolls and other relatively expensive bakery goods were included in deficient dietaries; the cheaper protein foods, dried beans and peas, were not often used; there was apparently little use of whole-grain cereals which would have improved the nutritive value of the day's meals without adding materially to their cost.

The failure of so many of the dietaries to meet the low standard set up raises a question as to the reliability of the method used in treating the data. To determine to what extent the two-day food records were representative of the food consumption for a week, 232 records from three of the ten schools were tabulated for the entire seven days. Fifty records were selected at random from the school having the largest number of dietaries which met the standard and fifty from the school having the poorest dietaries. Each included an equal number of boys and girls. From a third school all records complete for seven days were summarized. This included 59 boys and 73 girls, which is 79 per cent of the number previously reported for the school.

The results shown in Table III emphasize the inadequacy of the food intake of the school children of this investigation. With only one exception the results of the seven-day records show poorer dietaries than the two-day records. However, the differences are never large and in no case are they statistically reliable. On the whole the two-day records of dietary practices tended to be both accurate and a time-saving procedure. Moreover, in this study this procedure increased the number of cases by about 20 per cent.

TABLE III

PERCENTAGE OF DIETARIES MEETING MINIMUM STANDARDS: TWO-DAY RECORDS COMPARED WITH SEVEN-DAY RECORDS

Representative Schools*	Records	Number of Pupils	Per Cent Milk	Per Cent Vegetables, Fruits	Per Cent Proteins	Entire Standard
Best	2-day	185	88	72	96	63
	7-day	50	88	62	92	50
Median	2-day	168	68	33	85	22
	7-day	132	59	31	89	18
Poorest	2-day	168	53	31	90	18
	7-day	50	44	26	90	16

* Based on dietary records.

The study has clearly shown serious deficiencies in the dietaries of school children and the need for educating both the children and their parents in food values and meal planning.

CONCLUSIONS

The findings of the study and the general conclusions made by the nutritionists in their study of the records were presented to the principals and teachers of the ten schools who participated in the investigation. As a result many of the teachers appeared to take greater interest in their health work and attempted to plan their food teaching to meet the individual needs of the children in their classes.

In two of the schools series of weekly food demonstrations for parents were arranged. These classes were carried on by a home economics teacher and a nutritionist. Methods of cooking which best conserve food values were demonstrated, and attractive and nutritious low-cost dishes were prepared and were sampled by members of the class. Mimeographed sheets containing a guide for meal planning and sample menus for a day were distributed and discussed, and a few simple facts of nutrition were explained to emphasize the importance of planning meals in accordance with the food guide. The eating habits as well as food needs of children were discussed. The food classes proved to be pleasant social occasions, as well as educational, and it was felt that they built up a better understanding between the home and the school.

The Educational Responsibilities Outside the Classroom of Women Instructors of Physical Education in the State of Indiana

By Hilda M. Schwehn

Fort Wayne, Indiana, Public Schools

GENERAL TRENDS IN SECONDARY EDUCATION

TWO eminent sociologists have defined education, broadly considered, as "preparation for participation in the social institutions,"[1] such as the home, the school, and the community. Fretwell says: "The real purpose of education is to enable the individual to be increasingly intelligently self-directive."[2] At one time the classroom constituted the whole school. Now the gymnasium and playfield, the home-room, and the assembly are recognized as constituents of a whole situation. The responsibility of the school is to organize the whole situation to attain the aims and functions of secondary education which are the same as those of education in general. Teachers, therefore, must now assume not only added classroom responsibilities, but also duties outside the classroom.

Not only the teacher of physical education, but every teacher, faces problems very different from those which confronted teachers fifteen or twenty years ago. It is not enough that a teacher of the secondary school know her subject well and be able to present it adequately. The teacher finds herself responsible for many activities which are not carried on in the classroom or laboratory and which are not necessarily pursued during the regular school day. R. W. Bardwell in a recent paper said a teacher must "known how to proceed in giving aid and encouragement to those influences which are for the good of men."[3] A means for the "preparation for participation in the social institutions" is through student participation in extracurricular activities. The State Department of Public Instruction of Indiana recognizes the importance of these activities, and in a bulletin, *Extracurricular Activities for Indiana High Schools*,[4] outlines the objectives and purposes of extracurricular activities.

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[1] I. L. Finny, and L. D. Zeleny. *Introduction to Educational Sociology.* (Boston: D. C. Heath Company, 1934), 186.

[2] Albert K. Fretwell. *Extracurricular Activities in Secondary Schools.* (Boston: Houghton-Mifflin Company, 1931), 2.

[3] R. W. Bardwell. "What I Expect of a Physical Education Teacher." *Journal of Health and Physical Education,* 6:7 (September 1935), 16.

[4] State Department of Public Instruction of Indiana, Bulletin No. 100-J, 1928.

The education of the "whole child" can take place only through an integrated program of curricular and extracurricular activities. Every teacher, therefore, must assume many new responsibilities. Extracurricular activities and guidance in secondary schools have grown tremendously. The values to be found in the close connection of extracurricular activities and guidance with keeping students in school, recognizing individual differences in interests and ambitions, aiding students in exploring activities in many fields, have been shown to be indisputable. It is emphasized in the *Twenty-Fifth Year Book* of the National Society for the Study of Education that "extracurricular activities add to the cultural phases of a curriculum . . . train students in . . . some civic, social, moral quality or relationship."[5]

EXTENT OF EXTRACURRICULAR ACTIVITIES AND GUIDANCE

The extent of extracurricular activities and guidance varies from school to school. The large schools of Indiana provide in some instances for a director of extracurricular activities—a guidance or personnel director—whose responsibility it is to organize the program. This fact was established by the writer in a survey made of guidance in Indiana schools.[6] However, the cooperation of every staff member is necessary for the successful functioning of both the extracurricular and guidance programs. Many schools in this state expect their teachers to perform a great many "extra" duties. This fact is clearly brought out in this present study. Teacher-training institutions need, therefore, to provide the prospective teacher with a knowledge of techniques necessary for carrying out these added responsibilities.

In the first place, a teacher must realize the value of these activities. In the second place, she must have specific training and aptitude for the performance of this part of her teaching responsibility.

It will be pointed out that the prospective teacher needs added training and experiences in order to meet her new and enlarged responsibilities and an attempt will be made on the basis of this study to show the areas in which prospective teachers need training.

THE PURPOSE OF THIS STUDY

The present study is, as far as the writer has been able to determine, the first attempt to investigate the responsibilities beyond the classroom teaching load of the women teachers of physical education in the secondary schools of Indiana.

It is hoped that the study of this problem may be of help in the better organization of teacher-training curricula. It is also hoped that the conclusions reached in this study may help to guide prospective

[5] *Twenty-Fifth Year Book*, National Society for the Study of Education, Part II, p. 10.

[6] Hilda M. Schwehn. "Guidance in Indiana Schools." Unpublished Report, Purdue University, Division of Education and Applied Psychology, 1937.

teachers into campus extracurricular activities, which will assist them to direct such activities more adequately in secondary schools, and that teacher-training institutions will provide ways of making extracurricular activities of maximum developmental value.

This study presents data collected in the actual teaching field so that the teacher-training departments may acquaint prospective teachers with a better picture of the actual school situation.

It endeavors to answer the following questions: (*a*) What extra duties do teachers of physical education in Indiana perform beyond their teaching load? (*b*) What supplementary training and guidance can be offered which will more adequately prepare secondary school teachers for these duties?

METHOD OF OBTAINING AND CLASSIFYING THE DATA

The questionnaire method was used in obtaining the data. This questionnaire contained a list of teacher's responsibilities in a guidance program and many other activities in which the secondary teacher of physical education participates. The list was made partially from the results of a state guidance survey in the secondary schools of Indiana,[7] and from the literature written covering the field of extracurricular activities and guidance.

ADEQUACY OF SAMPLING

The questionnaires were sent to 212 women teachers of physical education in the high schools of Indiana.

(1) At least one teacher in every county of the State was sent a list so that the various sizes of high schools throughout the state are adequately represented.

(2) All of the 1937 women members of the Indiana Physical Education Association received a questionnaire.

(3) All graduates of Purdue who are teaching physical education received the questionnaire, because this study was primarily conceived to aid the Department of Physical Education for Women of Purdue University in its curriculum and teacher-guidance planning.

RELIABILITY OF THE DATA

The writer has been impressed with the high percentage of questionnaires returned and with the cooperative spirit of those who responded. The fact that the percentage of returns was 73.6 and that the questionnaires were not only filled out very completely but also that numerous personal notes and letters were attached gives evidence of a genuine interest in the study.

Because of a lack of time it was impossible to send a second form of the check list to the group chosen for sampling, which would have made the study statistically more reliable.

[7] Hilda M. Schwehn. *Op. cit.*

THE DATA

The questionnaires were divided into seven groups according to the school population as given by the State School Directory:

I	1 to 99	V	400 to 499
II	100 to 199	VI	500 to 999
III	200 to 299	VII	1000 and above
IV	300 to 399		

This division was made so that any relationship between significant differences and similarities in the data within different-sized school populations would be immediately apparent. When such relationships were evident, it was possible to make more significant groupings of the schools considered.

2. Each item in the questionnaire was tabulated separately for each of the seven groups.

3. Because differences in relation to school population were evident, the first three groups were combined to give data applying to teachers in schools of populations from 1 to 299. This group is called the Small School. Groups IV and V were combined, making the populations of the schools in this group 300 to 499. In the following pages this group will be referred to as the Medium School. The VI and VII groups with a population of 500 and above were combined to make the Large School group.

RESULTS

1. *Additional Subjects Taught by Physical Education Instructors.*— The number of instructors teaching physical education only and the number teaching physical education along with one, two, three, or four subjects is as follows.

	Total	S	M	L
Physical education only	20.5	5.6	13.8	55.8
Physical education plus one subject	25.0	20.0	34.8	32.6
Physical education plus two subjects	40.4	53.3	43.5	11.6
Physical education plus three subjects	12.2	18.9	8.7	0.0
Physical education plus four subjects	1.3	2.2	0.0	0.0

The above figures are self-explanatory and need no special comment. One significant fact which is worth pointing out is that since teachers without experience are not often immediately assigned to the Large School, they should be prepared in physical education and at least two other teaching subjects. The findings of this study indicate that over 50 per cent of teachers in the Small Schools are required to teach two subjects besides physical education, and over 40 per cent in the Medium School must meet the same requirement. Only 5.6 per cent of teachers in the Small School and 13 per cent of teachers in the Medium School are required to teach only physical education. This number is so small

that teacher-training institutions should train prospective teachers in at least two teaching subjects.

These results correspond with the findings of Marguerite M. Hussey.[8] William Moorehead says: "In Pennsylvania most of the teachers who have specialized in physical education are going in to situations where they have to teach more than just physical education."[9]

"Integration" is the watchword of many leading educators. The multiple-subject training of physical education teachers may be a step in this direction. The ability of physical education teachers to teach an teacher. It is then that the multiple-subject teacher is able to teach in another field for which she has been adequately trained.

THE EXTRA DUTIES OF THE PHYSICAL EDUCATION TEACHER

From the evidence as it is presented in this study, we find that the average number of "extra duties" of all teachers of physical education is 15.3. In all types of schools the physical education teacher performs many duties which are outside her teaching field.

The five duties listed first in all three types of schools are those of: studyhall supervisors, club advisers, class advisers, homeroom teachers, and health workers.

In the Small and Medium Schools, the schools in which the teacher will probably find her first teaching job, nearly 80 per cent are assigned to study hall duty. To direct a study hall skillfully requires definite techniques, which are, as far as the writer is able to discover, not taught in most teacher-training schools.

To advise club and class activities in such a way as to give pupils opportunities for experience in the social skills and practices, the teacher herself needs to have acquired social abilities and practices and also to have acquired a knowledge of techniques which are necessary to develop them in the adolescent through right programs. Class and club organizations provide a good setting for teaching cooperation. They also give an opportunity for exploration in the various vocational fields.

To list all the clubs which are found in all secondary schools would make a list much too long. Brewer says: "Some clubs stand out as clearly useful; notably clubs related to school subjects, governmental activities, musical organizations, publications, and athletics."[10] Undoubtedly, other clubs such as Camp Fire Girls, Girl Scouts, Girl Reserves, Girl's League, and Sunshine Girls have other useful purposes beyond the list mentioned by Brewer. Because teachers are often asked to help in these outside activities and because, undoubtedly, they serve

[8] M. Hussey. *Problems of the Multiple-Subject Teacher,* J. B. Nash, Editor. "Interpretations of Physical Education." Vol. V. (New York: A. S. Barnes and Company, 1935), 271.

[9] William Moorehead. *The Multiple-Subject Teacher in the Field.* "Interpretations of Physical Education." Vol. V. (New York: A. S. Barnes and Company, 1935), 276.

[10] John M. Brewer. *Education as Guidance.* (New York: The Macmillan Company, 1933), 232.

some useful function, these five organizations were included in the list.

The questionnaire contained a list of thirty-eight clubs. The results show that the physical education teacher has no responsibility as adviser in six of the clubs listed: physics, history, rifle, stamp, kodak, and garden clubs. To the list of thirty-two clubs checked, twenty-five others were added.

In the Small School, teachers added to the list: safety, Epworth League, honor society, Junior Red Cross, junior home economics, and table tennis clubs. In schools of this size, the number of clubs for which the physical education teacher acted as sponsor is thirty-three.
academic subject gives a feeling of security to those teachers of physical education who realize that participation in the various sports and the necessary demonstrations of specific skills is impossible for the older

In the Small School the order of occurrence of the first club listed is:

	Per Cent
1. Class Advisers	68.9
2. Girl's Athletic Association	44.4
3. 4-H Clubs	28.8
4. Home Economics Club	17.8
5. Hiking Club	14.4
6. Girl Scouts	13.3
7. Orchestra	11.1
8. Sunshine	10.0
9. School Paper	8.9
10. Glee Club and Bicycle Club	7.8

The responsibility as adviser for the rest of the clubs listed was assumed by only 5 per cent or less of the teachers in this group.

In the Medium School the order of occurrence of the first ten clubs is:

	Per Cent
1. Girl's Athletic Association	91.3
2. Hiking Club	39.1
3. Class Advisers	30.4
4. Girl Scouts	26.1
5. Bicycle Club	26.1
6. Booster Club	21.7
7. Girl Reserves	17.4
8. Social Dance Club	17.4
9. Girl's League	13.0
10. Dramatics, Swimming Club, Archery	8.7

There are twenty-five different kinds of clubs for which teachers in this size school act as sponsors.

In the Large School the number of clubs sponsored by the physical education teachers is thirty-three. The first ten in order of occurrence are:

	Per Cent
1. Girl's Athletic Association	88.3
2. Social Dance Club	30.2

3. Hockey Club	25.6
4. Hiking Club	23.3
5. Archery Club	18.6
6. Swimming Club	13.7
7. Class Advisers	13.7
8. Girl Scouts	11.6
9. Bicycle Club	11.6
10. Booster Club	7.0

Comparing the types of clubs which are listed among the first ten in the three types of schools, we find that in the Small Schools three have a direct bearing on the teaching of physical education; in the Medium School the number is six; and in the Large School, seven.

There follows a list of the number of clubs which an individual teacher sponsors. In the Large School the greatest percentage (23.3) of the teachers sponsor five clubs; in the Medium School the greatest percentage of teachers (26.1) sponsor two clubs; in the Small School the greatest percentage (24.4) of teachers direct the activities of either two or three clubs. The largest percentage of teachers represented in this study are advisers for two clubs.

It is also interesting and significant to note that 86 per cent of the teachers advise from one to five clubs; 11 per cent advise six or more clubs and only 3 per cent do not advise any club activities.

The significant fact established by the data is that prospective

NUMBER OF CLUBS ADVISED
BY ONE TEACHER OF PHYSICAL EDUCATION

	Total	S	M	L
0	3.2	3.3	0.0	4.7
1	21.2	24.4	13.0	18.6
2	21.8	24.4	26.1	13.8
3	13.5	13.3	13.0	13.8
4	17.2	17.9	17.5	16.3
5	12.2	5.7	17.5	23.3
6	3.9	3.3	4.3	4.7
7	1.9	2.2	0.0	2.4
8	3.2	4.4	0.0	2.4
9	1.3	1.1	4.3	0.0
10	0.0	...	...	...

teachers of physical education must expect to assume responsibility of club supervision. Since this is true, the necessity for their understanding the underlying educational purposes served by student club activities is immediately apparent. Techniques of club direction acquired through practice with clubs obviously are a great need for the prospective teacher.

From the data collected in this study it is evident that the teacher of physical education has the responsibility of planning programs for various types of clubs and organizations. Not only school clubs, but

also church and civic clubs expect the help of the physical education teacher.

Over half of the physical education teachers plan programs for school assemblies and club parties. Fifty per cent of the teachers in the Small Schools and the Medium Schools also plan programs for class parties and 37 per cent of the teachers in the Large School perform similar duties.

Over 20 per cent are responsible for programs in parent-teacher organizations. Although the percentage of teachers who plan programs for church and civic clubs is not large, it is large enough to warrant consideration.

In the Small School the teachers list eight additional activities for which they are requested to plan programs. They plan programs for an average of nine organizations. The Medium School teachers list two, making their responsibility for programs average 7.5 organizations. An average of ten organizations ask the cooperation of the physical education teachers in the Large School.

Not only without special training in club leadership and without previous preparation leading to a knowledge of results that might be achieved through club activities, but also without any or little experience in participation in campus club activities, teacher must be losing untold opportunities to develop in students those characteristics which will make them cooperative citizens of the school and of the community.

PLANNING PROGRAMS
A PART OF THE RESPONSIBILITY OF THE PHYSICAL EDUCATION TEACHER
(In Order of Emphasis)

	Total	S	M	L
School Parties	% 71.8	81.1	56.5	60.5
Club Parties	63.5	52.2	73.9	81.4
Class Parties	62.8	77.8	52.1	37.2
School Assemblies	58.3	58.9	65.2	53.5
Parent-Teacher Clubs	23.1	23.3	21.7	23.3
Church Clubs	21.2	21.1	30.4	16.3
Civic Clubs	13.5	10.0	21.7	16.3

McKown says: "The chief aims of the homeroom are (1) to develop desirable pupil-teacher relationships; (2) to assist in the guidance of pupils; (3) to develop desirable habits and ideals, personal and civic; (4) to expedite the handling of administrative routine educatively."[11] Administrators realize the value of the homeroom and are using this kind of organization frequently both in the junior and senior high schools. Davis considers the homeroom teacher a very important part, to a greater or lesser degree, of any efficient guidance setup. He maintains that it is with the homeroom teacher that the foundations of

[11] Harry C. McKown. *Extracurricular Activities.* (New York: The Macmillan Company, 1930), 13-43.

guidance must be laid. The frequent use of this kind of organization in the secondary schools of Indiana is indicated by the number of teachers who reported the performance of homeroom duties. To make the homeroom period a worth-while part of the education of the students in the practical arts of citizenship, teachers need to have a knowledge of skillful procedures.

In this survey there are listed twenty-two discussion topics which are used during the homeroom period. First in the list is the discussion of attitudes. The variety and kind of topics which were discussed by the teachers with their homeroom groups are indicative of the fact that the homeroom period is used for definite educational purposes. An analysis of the topics discussed shows that 14 per cent pertain to individual problems of conduct and behavior, four to school problems, two to civic obligations, and two—safety and first aid—to school and civic problems.

A mastery of techniques of group discussion is important for all teachers, for it is in the informal discussion group that much of the teaching for social adjustment is done. Sound educational philosophy must underlie group discussion procedures if the homeroom discussion periods are not to be primarily waste time for the student.

School Health Problems and the Physical Education Teacher.—If the Seven Cardinal Principles of Education[12] are to be taken as the

THE PHYSICAL EDUCATION TEACHER AND SCHOOL HEALTH PROBLEMS

	Total	S	M	L
Group discussions on health problems	41.0	34.4	52.2	48.7
Medical examination	38.5	33.3	56.5	39.5
Room for rest	36.5	46.7	39.1	13.7
Follow-up medical examination	36.6	28.8	52.1	37.2
Health supervision of school plant	23.7	16.7	34.8	32.6
Direction of school lunch	19.2	25.6	13.0	9.3
Serve milk between meals	5.8	5.6	4.3	7.0
Health talks	1.3	1.1	0.0	2.3
Posture examinations	0.6	0.0	0.0	2.3
Administer first aid	0.6	0.0	0.0	2.3
Special rooms for crippled children	0.6	0.0	0.0	2.3

objective of every teacher, it necessarily follows that health is the first objective in any educative procedure. To keep the bodies of students well and strong is the duty of every teacher. To the physical education teacher much of the responsibility of all activities which may be classed under the term "health guidance" naturally falls. The teacher of physical education can serve, in part at least, as a health counselor along with the physician, the nurse, the administrator, and other members of the

[12] U. S. Bureau of Education, *Cardinal Principles in Secondary Education*, Bulletin No. 35, 1918.

teaching staff. In the questionnaire were included duties which in some places are the duties of the doctor or nurse exclusively. It was intended to find out how many physical education teachers assume, in part at least, some of these duties.

Miscellaneous Responsibilities of the Physical Education Teacher.—The teacher performs many other duties which lie outside the regular teaching assignment. This list of duties contains a variety of responsibilities. It contains, for the most part, the teaching of special classes and those duties related to vocational and social-civic guidance.

It is shown that 35 per cent of the teachers of physical education conduct special classes in courtesy and etiquette. The largest per cent of teachers teaching these classes is found in the Small School where 45 per cent assume this responsibility.

Special classes in leadership training are most often taught by the teachers in the Large School. The teachers of the Large School most frequently teach adult classes. The total number of teachers teaching adult classes in the Small and Medium School is small. Because, however, of the new emphasis now placed on adult education, the responsibility of teaching these classes will be increased, perhaps, for teachers in the three types of schools. A. S. Stephan says: " . . . In adult education the schools have lagged rather than led . . . the next advance in popular education in this country will be in adult education. . . . The public adult education enterprises in the future will doubtless be increasingly centered in the school."[18]

Three duties, namely, planning lectures on vocations, arranging for student interviews with business men, surveying the field of jobs which are available in the community, are done by a small percentage of teachers.

Responsibility of the Physical Education Teacher for Teacher-Parent Conferences.—A total of 38.5 per cent of all teachers indicated that they have conferences with parents. The percentages of teachers varied slightly from school to school; 48.8 per cent of the teachers in the Large School indicated that they have conferences with parents; 36.6 per cent of the teachers in the Small Schools, and 26.1 per cent of the teachers in the Medium Schools.

There are fifty-seven different topics which teachers discussed with parents. There was no outstanding difference in the type of discussion that teachers in the three types of schools had with the parents of their students. All topics which are listed can be placed in five classifications: those related to the student's health, scholastic and school problems, behavior problems of the student, home interest problems, and those related to physical education programs. When this arrangement of

[18] A. S. Stephan. "Adult Education and the Public Schools," *School and Society*, 46 (Nov. 27, 1937), 691.

topics is made, it is apparent that four types of discussion are related to the health of the student: student health, physical defects, diet, and cleanliness. Nine topics are related to home interest problems: parent-pupil understanding, leisure of the family, home conditions, outside work of students, cooperation of home and school, and 4-H club work at home. The ten topics related to the physical education program are: physical examination, gymnasium equipment, accidents in the gymnasium, posture, shower regulations, athletics, physical education and health programs, physical abilities, intramural programs, and excuses from gymnasium work. Twelve personal behavior problems are: pupil's conduct, interests, attitudes, abilities, social life, out-of-school interests, student's recreation, table etiquette, character, student's clothing, club activity, and plans for the future. Fifteen topics can be classified best under the heading of scholastic and school problems. They are: education in general, school programs, school work, student's progress, method of grading and grades, unsatisfactory or failing work, reasons for failure, study habits, achievement, attendance, discipline, tardiness, room and school improvement, citizenship, and 4-H club work.

The cooperation of parents and teachers in the solution of student problems is considered by a great many educators to be of prime importance. This study shows that many teachers discuss their students' problems with the parents of those students and are trying in some measure, at least, to help students to reach a maximum of attainment.

The Duties of the Physical Education Teacher in Re-education Programs.—From the results of this study it is evident that the Small and Medium Schools expect the teachers of physical education to assume re-education duties more often than does the Large School. The duties which are performed by more than 10 per cent of the teachers in the Large Schools are: training in study habits, re-education of unruly students, planning emotional adjustment programs, re-education of the anxious or withdrawn student, and re-education of the dishonest students. The percentages of teachers who assume these duties vary from 16.3 to 11.6.

In contrast it is evident that over 20 per cent of the teachers in both Small and Medium Schools assist in the study of students with low grades, the training in study habits, re-education of dishonest students, re-education of students in personal morals, and the re-education of anxious or withdrawn students. The reason that the number of teachers who perform re-education duties in the Large School is comparatively smaller may be that a specialist is employed to plan, and for the most part, execute these duties; whereas the teacher of the Small and Medium School is asked to give assistance in this part of the school program.

Confusion is apt to result when teachers without training and

supervised practice in case study techniques and in individual adjustment techniques undertake to re-educate a student in any of the areas named.

The Responsibility of the Physical Education Teacher in Community Projects.—The total number of projects in which teachers feel they have to participate is fifty-four. The total number in the Small School is twenty-three, in the Medium School sixteen, and in the Large School twenty-four.

In no instance are there more than 7 per cent of the teachers of the Large School who participate in any one of the community projects. Those in which these 7 per cent participate are: parent-teacher organizations and girl scouts.

In the Medium School, 17.4 per cent of the teachers participate in the Red Cross, 13 per cent in church attendance, and 8.7 per cent in Girl Scout and parent-teacher organizations.

In the Small School, 12.2 per cent of the teachers take part in church projects, such as church drives, and the various organizations of the church; 7.8 per cent in the parent-teacher organizations, and 5.6 per cent in church attendance and home-economics clubs.

In the Small School, participation in church projects is expected of the largest number of teachers.

The results of this study show that teachers in all schools will be expected to take part in community projects which will, of course, vary with the particular community in which the teacher finds herself.

Five Related Duties for Student Guidance.—

THE NUMBER AND PERCENTAGES OF TEACHERS WHO ARE DOING SOMETHING IN EACH OF THE FIVE DUTIES

	Total	S	M	L
1. Teachers who give one or more tests	50.0	53.3	52.2	41.9
2. Teachers who collect records other than administrative ones	80.1	78.9	82.6	81.4
3. Teachers who advise clubs	96.7	96.7	100.0	95.3
4. Teachers who conduct classes in leadership, courtesy, and etiquette and lead home-room discussions	46.1	58.9	43.5	48.8
5. Teachers who are responsible for the re-education of students	59.6	65.6	78.3	37.4

In order that guidance or direction may be effective, measurement of student abilities is necessary. One-half of the teachers who contributed to this study give one or more tests. To be able to give tests and then interpret test results for diagnostic and remedial purposes is important for all teachers. Teacher-training institutions should, therefore, make provision for adequate training of teachers for their responsibility in a testing program.

Not only tests, but also records of home, outside interests, et cetera, are important if an accurate profile of the student is to be drawn. This is recognized by the administrators of the schools of Indiana, for 80 per cent of the physical education teachers indicate that they keep some kind of records. Prospective teachers should be given a knowledge of the techniques and actual practice in the recording and interpretation of facts.

It is through club activity that growth and development of the student take place. Over 90 per cent of the teachers are advisers for one or more clubs. It is obvious, then, that in order to use the club activity for creative purposes, teachers need not only the knowledge of club procedure but also practice in planning club activity which will develop in students desirable characteristics.

Classes in leadership, courtesy, and etiquette, and homeroom discussions are three means through which student growth and development are fostered. Nearly half the teachers use one or more of these means through which they help students to develop to a maximum of their abilities.

In any school it is necessary to re-educate some students. The percentage of teachers who are responsible for a part of the re-educative program is 59.6. To measure, diagnose, and then re-educate students is an important part of the school's responsibility. The teachers in all schools need to know when, why, and how to measure, to record, to diagnose, to employ proper techniques for the maximum development of students into useful citizenship.

CONCLUSIONS AND RECOMMENDATIONS

Whatever value this study may have depends upon the contribution it may make toward a better organization of teacher-training curricula and guidance through a better understanding of the responsibilities which teachers have beyond their teaching load.

This study, as well as other recent studies, shows that a large number of teachers are multiple-subject teachers. Three such studies are quoted in the October, 1933, RESEARCH QUARTERLY. Rogers says: ". . . in the future there will be a demand for physical education teachers qualified to teach in the academic fields."[14]

In addition, there is some professional recognition that there will be a demand not only for the multiple-subject teacher, but also for the teacher who has been trained to assume the many important out-of-class responsibilities which are indicated in this study. Bear says: "In one way or another most of the contemporary proposals for making the school more effective depend also upon the individual whose prin-

[14] James E. Rogers. *The Demands for Professional Preparation.* J. B. Nash, Editor. "Interpretation of Physical Education." Vol. V. (New York: A. S. Barnes and Co., 1935), 172.

cipal duty is teaching. More is demanded of the classroom teacher than ever before . . . even larger demands will be made."[15]

Briggs has made two studies on the demand for and the preparation of teachers in the extra-class activities. The first study, *The Demand for Teachers Prepared to Guide and Direct Extra-Class Activities*,[16] is of wide enough scope to be very significant. He sent a questionnaire to principals of high schools in forty-five states. All types of teaching situations are represented for the populations of the schools which these principals represent are from very small to very large. This study shows that over 90 per cent of the principals asked that high school teachers be given laboratory experience in guiding and directing extra-class activities such as assemblies, clubs, class organizations; one suggestion from principals of the midwest high schools was that prospective teachers have a course in extra-class activities. Briggs summarizes his findings in part as follows: "Approximately three-fourths of the teachers in the nation participate in guiding and directing extra-class activities in high school . . . four out of five principals want teachers to have training in conducting assemblies . . . three out of four want teachers to have training in guiding and directing club activites . . . seven out of ten want teachers trained in class organization and extracurricular activities." The results of this study show that there is a demand for teachers who are well trained in extra-class activities.

In his second study, Briggs made a survey of state teachers' colleges in order to determine what these colleges are doing to train prospective teachers to meet the demand of added educational responsibilities which they will assume in a teaching assignment. He found that ". . . one state teachers' college in five gives attention through curricula to the very important preparation of secondary school teachers for extra-class activities . . . no provision for practice in guiding and directing of extra-class activities is scheduled in the curricula of state teachers' colleges."[17]

The writer suggests that our colleges and universities train teachers to meet these demands through additional training and laboratory experience in many areas which are not at all or at least only slightly touched at the present time.

To train teachers adequately to meet these demands, the writer makes the following recommendations:

1. Each prospective teacher shall have an adviser, or small groups shall meet together regularly with the same adviser, whose duty it is to help the student teachers select those courses and participate in those

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[15] Robert M. Bear. *The Social Functions of Education.* (New York: Macmillan Company, 1937), 406.

[16] Eugene S. Briggs. "The Demand for Teachers Prepared to Guide and Direct Extra-Class Activities," *School and Society*, 45 (May 15, 1937), 693-696.

[17] Eugene S. Briggs. "Extra-Class Activities Offered in State Teachers' Colleges," *Education*, 58 (Jan. 1936), 307-311.

activities which will help them to attain a maximum development throughout the four years they are in college.

2. As a basis for the additional educational duties that teachers of physical education must perform, the teacher must concern herself with the complete growth and development of the child. The courses which are essential must include every important aspect of psychological growth and development. The following courses are suggested as being necessary to prepare the prospective teacher to meet the inevitable responsibilities revealed by this study.

a) Adolescent Psychology.
b) Mental Hygiene of the School Child.
c) Mental Hygiene of Parent-Child Relationships.
d) Supervised Practice in Parent Teacher Cooperation.
e) The Collection and Use of Functional Data (pertaining to the individual child).
f) Principles of Appraisal of Individual Differences (selected tests and measurements).
g) Supervised Practice in Individual Case Study Methods.
h) Supervised Practice in Therapy (methods in personal adjustment and individual re-education).
i) Principles and Techniques of Guilding Group Activities (clubs, etc.).
j) Supervised Practice in Club Direction.
k) Advanced Course in Health Education (pupil and plant supervision-instruction, service).
l) Developing the Student Through Subject Matter (principles of curriculum building).
m) The Teacher and the Community.
n) Practical Experience in Community Organization.

Many university requirements for graduation are now so great that it is impossible to add many courses. It will become necessary to reconsider the plan of teacher preparation to determine how the necessary courses can be introduced into teacher preparation to insure sending into the schools of the state teachers who can actually carry on effectively the many kinds of educational service which they are called upon to render.

Some students of this problem advocate a five-year training period,[18] and after an analysis of the situation as presented in this study, it is evident that more than four years are needed for the adequate preparation of teachers unless portions of the present four-year course are eliminated to make way for new material.

There is, however, one area in the training of physical education teachers which can be developed immediately with little cost and no reorganization of the university curriculum. Prospective teachers should have experience in many extracurricular activities on the campus, where

[18] Stuart M. Stoke. "Fifth Year for Secondary Schools at Mount Holyoke," *School and Society*, 43 (April 11, 1936), 510-512.

many worth-while activities are available. The writer proposes that an adviser to prospective teachers help these students select those activities which will render their participation in student activities as rich as possible in personal development and professional preparation, and which will make them efficient teachers in the high schools of Indiana.

Zora Klain. "Beyond Traditional Four Years," *School and Society*, 45 (June 19, 1937), 860-862.

Thomas A. Benner. "Present Status of the Preparation of Secondary School Teachers," *Institute for Administrative Officers of Higher Institutions, Proceedings 1935*, Vol. VII., 22-30.

Sidney L. Pressey. "The Present Crisis in Teacher Training," *School and Society*, 46 (June 1937), 18-20.

A Study of Falls in Skiing

By Raymond Elmer Smart, Jr.
Massachusetts State College, Amherst

THERE was a time, upwards of two decades ago, when automobile accidents were few and far between. But that was when there were very few automobiles. Today the accident rate is of concern to everyone. So it is with skiing. A few short years ago skiing accidents were almost unheard of; but so was a skier. With skiing nearly as popular as motoring, ski accidents are becoming more frequent.

Much has been done to cut down the number of highway accidents; patrolling the roads, posting them, changing the curves, and broadening them. The same thing is being done as regards trails for skiing, to some extent, but there is much more to be done. If we are to cut down ski accidents, what approach should we take?

In searching for an approach to the ski accident problem, it seems logical to look to the causes of accidents before attempting any cures. Where falls take place, there are accidents. A close study of the falls should produce the reasons for these accidents. It should show us the bad curves, schusses, and other undesirable features of our trails.

Perhaps we may expect more than this from our study of falls. Of late we have heard cries about ski patrols to reduce accidents; also of instruction, better equipment, and first aid. A study of falls may cast some light on the need for intruction and ski patrols. Equipment may also have a definite relationship to ski injuries. It would seem that such a study may show something of value in the avoidance and care of injuries sustained while skiing. Having seen some of the possibilities of such a study, we have proceeded, with the idea in mind to develop better ski trails.

A STUDY OF FALLS AS RELATED TO SKI TRAILS

We began work with the idea of finding, first of all, examples of desirable and undesirable construction of ski trails. This was simple and obvious enough. An area on a trail where falls occur with great frequency certainly is not desirable, while long speedy stretches practically free from falls are what every trail runner likes. We decided to look for areas such as these on some of the better-known ski trails, and to determine, if possible, just what principles should be considered in future trail construction.

In covering a trail, the idea is to distinguish sections of it by the number of falls in that section. To do this, it is necessary to know where the falls occur on the entire length of the trail over a period of time. This may be done by covering the whole trail and making a spot map

of falls on several occasions. The system employed is to have a series of observers stationed along the trail. Each man is given a map of the section he is to cover. As a skier goes by and falls, the fall is noted on the map.

Our spot maps show us where the falls take place, but the determination of the reasons for these falls is a different problem. The heavily spotted areas probably need to be studied on the ground to reach a conclusion. However, a concensus of opinion may be available from the skiers whose falls are spotted concerning the undesirable features of the trail. This may be obtained by interviewing each skier at the bottom of the trail, questioning him as to the number and whereabouts of his falls and reasons for them (See Chart I).

CHART I

FACTORS CHECKED IN SKI FALLS TABULATION

Skier's number.
Skier's time.
Skier's classification.
How many times did skier fall?

Falls attributed by skiers primarily to external causes: (Put down letter or just check).

1. Faulty trail (A, B, or C—A, too narrow; B, very bad corner; C, hidden rocks or stumps).
2. Poor snow conditions (A, B, C, D, E, or I—A, ruts; B, bumps; C, crust; D, wet; E, bare; I, icy).
3. Visibility poor.
4. People or skiers in way.
5. Faulty equipment.

Falls attributed by skiers primarily to themselves:

1. Going too fast for ability or conditions—carelessness.
2. Lack of experience.
3. Fatigue or poor physical condition.
4. Misjudgment.

Remarks:

If this system is used upon several occasions, as we suggest, other contributing factors besides design and construction must be considered. Snow and weather conditions, the ability of the individuals, and speed of their runs are factors which may completely change the picture.

In compiling such data, it is evident that the event of a downhill race offers an excellent time for such a study. There are several reasons for this, besides avoidance of confusion, which is the main one. The trail is being put to a real test in a race. The skiers are doing their level best not to fall; and they are in the same classification groups, narrowing down the ability of individual factor in falls. Of course, recreational skiing days might be considered in order to find how the trail suits the average ski runner,—for the man in competition is generally better than average.

STUDY OF THE THUNDERBOLT SKI TRAIL, MT. GREYLOCK, MASSACHUSETTS

The Thunderbolt Ski Trail, Mt. Greylock, at Adams, Massachusetts served as our laboratory. A summary of the work done there follows.

In this study we followed the ideas set forth in the preceding paragraphs and covered two of the major downhill races of the year; namely, the Eastern Downhill Championships on February 6, 1938, and the Massachusetts Downhill Championships on February 27, 1938.

With C.C.C. boys from Mt. Greylock Camp as observers, spot maps of all the falls in both these races were made. Observers stationed along the entire length of the trail were supplied with maps, and as a skier fell, the place where the fall occurred and his number were spotted on the map. At the finish, the skier was questioned as to the number of falls he took, where they were, and what he thought were the causes of the falls. Snow, weather, and trail conditions were also noted.

From the tabulation sheets of the race (Eastern Downhill Championship, February 6) we find that 35 skiers started the race, 31 of these finished, 2 of the 4 not finishing the race were injured. There were 49 falls in all, 11 occuring at Needle's Eye.*

The summary of falls of skiers in this race is as follows:

Of 31 skiers finishing, 64.5 per cent fell one or more times.
Of 35 skiers racing, 68.6 per cent fell one or more times.
Of 35 skiers racing, 22.4 per cent of all falls occurred at Needle's Eye.
At Needle's Eye, 20.9 per cent of the falls resulted in injury.

From 26 skiers (A and B rating) whom we were able to interview upon completion of the descent, the following information was obtained:

Trail		Skier Himself	
Causes	Falls	Causes	Falls
Hidden rocks, stumps	9	Too great speed	5
Bad corner	1	Fatigue or poor physical condition	5
Poor snow conditions	9	Misjudgment	5
Total	19	Total	15

These 34 falls give an average of 1.31 falls per skier.

This data was obtained from 26 of the 31 finishing skiers, in some degree accounting for the discrepancy between the total falls given here and the number recorded on the tabulation sheets by recorders along the trail. When interviewed at the end of the run some of the skiers had forgotten, intentionally or otherwise, the exact number of falls they had taken.

From the tabulation sheets of the Massachusetts Downhill Championships, February 27, we find that 34 skiers started the race and that

*Needle's Eye is a particularly sharp and narrow curve in the run.

all finished, with a total of 59 falls occurring during the race, 8 being at Needle's Eye.

The summary of falls of skiers in this race is as follows:

Of 34 skiers finishing, 70.5 per cent fell one or more times.

Of 34 skiers finishing, 14.6 per cent of all falls occurred at Needle's Eye.

There were *no* injuries in this race.

Thirty-two of the 34 skiers were interviewed at the end of the race. The following information was obtained:

Trail		Skier Himself	
Causes	Falls	Causes	Falls
Hidden rocks	2	Too great speed	17
Bumps	1	Fatigue or poor physical condition	3
Icy conditions	14	Faulty equipment	1
Skiers in way	1	Misjudgment	4
Poor visibility	11		
Total	29	Total	25

These 54 falls give an average of 1.68 falls per skier.

The observers recorded 59 falls, apparently the skiers "forgot" 5 falls.

COMPARISON OF THE RACES STUDIED

A glance at the spot chart shows that the falls in these two races were fairly well bunched, and occurred in four distinct areas. Although there are a few scattered falls, the great majority of them happened at these four places. Another thing that strikes the eye in looking at the chart is the great number of falls in the race of February 27th as compared with that of the 6th. The reason for this is mainly because of the greater number of skiers checked in the race of the 27th. In the February 6th race, 35 skiers participated; and in the race of the 27th, we included the falls of the participants in the time trials which followed the race, giving us 50 to 55 skiers. (It is to be noted that the spot chart includes the falls of the skiers in the time trials as well as in the race, but the tabulation sheet accounts only for the falls by the skiers in the race, on the 27th.)

Race of Feb. 6th		Race of Feb. 27th	
Area	Percentage	Area	Percentage
No. 1	16	No. 1	24
No. 2	18	No. 2	10
No. 3	24	No. 3	18
No. 4	16	No. 4	37

The four major fall areas mentioned above, and numbered on the chart as No. 1, No. 2, etc., show quite plainly that the falls were nearly all bunched in these areas, but the close observer will discern that the

CHART I

proportion of the falls occurring in each of these areas varies in comparing the two races. The following data bears witness to this observation, showing the percentage of falls occurring at each of these spots in the two races.

The rather large differences in proportion of distribution of the falls between the two races are undoubtedly because of the snow and weather conditions. For instance, on February 6, parts of the trail had a noticeable lack of snow, and this condition was in part responsible for

the large percentage of falls at Fall Area No. 3. On the 27th, this was amply covered and the percentage dropped from 24 to 18 per cent. Then again, on the 27th, it was snowing, varying from a light to a considerable fall during the race, which cut down visibility. Fall Area No. 4 consists of a long schuss of about 200 yards with a rise at the bottom just across a bridge. In descending this schuss, a skier attains considerable speed, and with the snow coming down, visibility became a factor of great importance. A look at the map discloses that most of the falls here were at the bottom of the schuss; thus, without a doubt, poor visibility raised the percentage of falls at this place. With no such handicap on the skier, that area accounted for only 16 per cent of the spills on February 6th, as against 37 per cent on February 27th.

So much for the spot map; it has shown us where the falls are occurring. In looking for the reasons, let's turn to the results of the questionnaire.

Our questionnaire shows that the skiers attributed about the same percentage of falls to the trail conditions in both cases, 54 per cent and 56 per cent. Among the reasons for falls mentioned by the skiers, and shown on the summary sheet, it is noticeable that practically none of the reasons mentioned blamed the trail itself, but rather the weather and snow conditions. The only other item of import here is the "hidden rocks and stumps" cause, and with a greater depth of snow, this item would probably have been eliminated.

Such a questionnaire, we have found, is not too accurate, for in the excitement of a race many things are forgotten. Frequently a skier is in no condition to be interviewed; he is too tired or excited. The lapse of memory of some skiers has already been commented on in the summary sheet, for some did not even remember how many times they had fallen. Though the results of the questionnaire prove interesting, it seems advisable to look elsewhere for the causes of falls.

It is interesting to note on the summary sheets of the questionnaire that in the February 6th race, where the skiers all had an *A* or *B* rating, they fell an average of *1.31* times each; while in the race of the 27th, where the skiers were *A*, *B*, and *C* rated, they fell *1.68* times each. This seems as it should be, with the larger percentage of falls going to the lower rated skiers.

The spot chart has shown where the falls occur. In determining the causes, we go to these spots on the trail. The great majority of the falls come in four places, as has been pointed out; giving us four areas to investigate. If falls occur at a particular point, either something at that spot causes falls, or, more likely, the skier loses his equilibrium in the approach to the point.

Fall area No. 1 is a series of curves to the right, several hundred feet long. The falls occur from the 2200- to the 2600-foot mark. The

trail is without obstacles and 20 to 60 feet wide along there. The approach from the 1500-foot mark has a gradient of about 35 degrees, however. It would seem that skiers enter the long curve at a great rate of speed, in fact, too great. However, there is ample opportunity for them to check if they desire; for the trail is wide enough. Apparently they do not desire to do so.

Fall area No. 2 is the heavily spotted area at the 3300- to 3500-foot length of the trail. This stretch is 20 to 30 feet wide, without obstacles, and has a grade of 15 degrees. The preceding 300 feet of approach have the same characteristics, with a fair curve at the 3000-foot mark. The skier has plenty of impetus left from his descent of the foregoing 800 feet with its gradient of 30 degrees and better, but there seems to be nothing in the trail construction that should cause an undue amount of falls here.

Fall area No. 3 runs from the 4100-foot mark to approximately the 4500-foot mark. It has a 20- to 30-degree grade, growing steeper as the skier continues through it. The area is from 20 to 12 feet wide and is known as the "Needle's Eye" because of its characteristic narrowness. Sharp opposite turns make it difficult to negotiate at a great rate of speed. Comparatively, the approach is not as steep as some others, and is somewhat wider, 20 to 30 feet, allowing the skier room to check if he is skiing under control. On February 6th, this area was bare in some spots, and rutty in others. This is probably the most difficult part of the trail on which to ski at high speed.

Fall area No. 4 is a steep schuss extending from the 5200- to the 5500-foot marks, or as far down as the bridge. The grade along here is from 30 to 35 degrees, and then approaches level at the bridge. The schuss is 25 to 40 feet wide, and bumpy. The 100 feet beyond the bridge is slightly uphill, and contains a good percentage of the falls in this area. The curve just before the bridge is wide but of less than 100-foot radius. If a skier takes the schuss "wide open," the bumps tend to throw him off balance and he is unprepared for the curve and rise beyond.

In studying these fall areas on the ground, even a brief survey as shown above will bring to light the reasons for falls in the majority of cases. This is the point we attempted to show. Whether or not the number of falls in these areas are unduly large and should be corrected, we do not go into in this study. These things cannot be determined on an experimental basis, as yet. For instance, there are certain construction practices present on this trail which seem contributory to falls, which have been used as safety precautions. With these we have no argument. One of these practices is the bumps, referred to under the discussion of Fall area No. 4, but which are also found in many places on the trail. The purpose of these, we are informed, is to keep the inex-

perienced trail runner from having a severe injury. This class of skier is bound to get onto the trail at times, and in many cases will run it faster than is good for him. The bumps will generally cause him to fall or at least check, before he gets going fast enough to do himself real harm. At least this is the intent of the trail builders.

CONCLUSIONS

It is evident that a discussion of desirable practice in construction and design at this stage of the study would be out of order. But we may conclude that our experiment has been a success in that it has brought forth a method of conducting the survey.

The "spot map" is indispensable in locating fall areas. It takes a number of helpers to draw up one, but it is simple in character. Once the trouble is located, measures may be taken for improvement. The questionnaire of skiers' opinions is too inaccurate to get a reasonable concensus of opinion.

This cannot be done on a mass basis, for each trail is a problem in itself and should be attacked as such. If improvement of a particular trail is desired, "spot map" it for falls upon several different occasions; determine the fall areas; study these on the ground, and decide on measures to be taken.

However, the study should not stop with each individual trail as a problem conquered. The study is much greater and more general than that. Though each trail is a problem in itself, the solution may be applicable to more than that one trail. The compilation of the data from a great many of these "problems" will certainly show the types of construction to avoid. This knowledge will be invaluable in the development of new trails. National and state parks as well as private clubs and individuals are developing new trails all the time. Should the opening of a new trail just be the creation of another "problem" to solve? Certainly not! Ski trails are made to be used. Constant accidents and falls will impair the popularity of a trail the same way that a few drownings decrease the use of a swimming pool. If the park service or private individuals are to put money into ski trails, they must be made attractive enough to be popular, and this includes a lack of danger.

Of course, as soon as a trail is made attractive enough to be popular, we have another danger problem. Sleds, jumpers, toboggans, and incompetent and careless skiers all appear. The only solution of this is patrolling. Patrolmen are as necessary there, as life guards at bathing beaches.

But, as to the track itself it seems only good common sense, that where the spending of money is involved, the procedure recommended is sound. This includes the study and solution of the mistakes already made in design and construction, and the avoidance of such undesirable features in the future.

Studies of the Johnson Test as a Test of Motor Educability

By Eleanor Metheny
State University of Iowa

INTRODUCTION

In 1932, Granville B. Johnson[1] * presented a simple test to be used for sectioning classes into homogeneous units. This test consisted of a series of ten exercises, jumps, hops, rolls, and turns, which were executed upon a pattern painted upon a canvas mat.† He reported that his test had a reliability of .97 and a validity of .69, although he did not state against what criterion it was validated. In 1935, Barton[2] experimented with this test and with other similar items on junior high school girls and concluded that the Johnson type test was more accurate than the Brace[3] type of test for measuring motor educability, but that it required much more time for administration. In 1936, Roads[4] reported a similar conclusion for senior high school girls. In 1937, Koob,[5] using as his criterion of motor educability the number of trials required for junior high school boys to learn a series of ten tumbling stunts, found a correlation of .969 between the Johnson test and motor

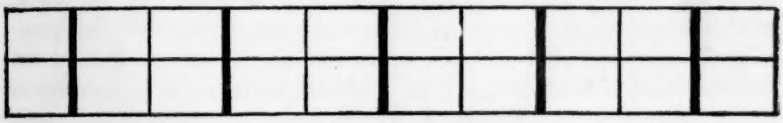

Figure 1. Simplified mat for administering the Johnson test.

* Numbers refer to Bibliography at end of article.

† Because this test is not as well known as it deserves to be and the reader may not be familiar with the exercises included, a brief description of each is given below, with the kind permission of Dr. Johnson. These exercises are performed on a canvas four and one-half feet wide and fifteen feet long, upon which is painted a pattern of small rectangular targets, large squares, and a two-foot lane for the rolls. Each exercise is scored ten for a perfect performance with deductions for errors according to directions given in the original description of the test.

1. Straddle Jump—With hands on hips, the subject jumps from a position with feet together on the targets to a straddle position with feet apart on the squares.
2. Stagger Skip—With hands on hips, the subject alternately steps and hops on the targets and squares for the length of the mat.
3. Stagger Jump—With hands on hips, the subject jumps with both feet in a zig-zag course down the mat.
4. Forward Skip, Holding Opposite Foot from Behind—Subject hops alternately on right and left feet, holding opposite foot from behind with the hand.
5. Front Roll—Subject performs two front rolls in the two foot lane.
6. Jumping Half-turns, right or left—Subject jumps with both feet from target to target, executing either a right or left half turn with each jump.
7. Back Roll—Subject performs two back rolls in the two foot lane.
8. Jumping Half-turns, right and left alternately—Same as 6, except that right and left half-turns are made alternately.
9. Front and Back Roll Combination—Subject performs a front roll, rises, pivots, and performs a back roll in the two foot lane.
10. Jumping Full Turns—Similar to 6 and 8, except that full turns are made and subject jumps from square to square instead of on the targets.

educability, and a correlation of .814 between the Johnson test and the scores made on three track and field events. The results of these three experimenters, plus experience with the Johnson test in class work, led to the conclusion that it was a good test of motor educability, but that it would probably never attain the widespread use it deserved because it required so long to administer. This conclusion prompted the investigations presented below.

THE DATA

The data* consisted of the scores of one hundred junior high school boys on the separate items of the Johnson test, the number of trials necessary for each boy to learn ten tumbling stunts of varying degrees of difficulty, and scores on the 50-yard dash, the running high jump, the standing broad jump, and chinning strength scored according to McCloy's[6] formula. The boys had had no previous tumbling instruction.

THE PROBLEM

The original purpose of this study was two-fold: (1) To analyze the items of the Johnson test by the multiple factor technique in an attempt to isolate the primary components of the test; and (2) to try to devise some method for reducing the time required to administer the test, and, if possible, to simplify the equipment needed. In the course of the investigation, however, a third and even more interesting possibility became apparent and was added as: (3) To try to devise a test battery which might be used for research purposes as a measure of motor educability independent of the influence of strength and speed. These three problems are discussed in the order listed.

PART I

Intercorrelations were computed for the sixteen variables mentioned in Table I and this matrix was analyzed by the Thurstone multiple factor technique,[7] in an attempt to isolate the principal components which make up the test. The track and field events and the chinning strength were included in this analysis because it was felt that they might be of value in identifying the factors found. Three definite factors were isolated and the factorial matrix rotated according to Thurstone's directions. The rotated factor loadings are shown in Table II (page 108).

Factor I, which is high in the dash and jumps but low in strength, was identified as contraction speed of muscle (or, using Hill's[8] terminology, muscle viscosity), or, more simply, speed of movement. Of the Johnson items, those highest in this factor are the front roll and the front and back roll combination. The low loading of the back roll in

* I am indebted to Mr. Clarence Koob of Dubuque, Iowa for his kindness in providing me with these data.

TABLE I

Zero Order Correlations

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Straddle Jump																
2. Stagger Skip	.494															
3. Stagger Jump	.573	.564														
4. Forward Roll	.359	.441	.649													
5. Front Roll	.325	.360	.582	.433												
6. Jumping half-turns, R or L	.316	.278	.364	.288	.319											
7. Back Roll	.380	.567	.398	.383	.390	.451										
8. Jumping half-turns, R and L	.453	.459	.548	.430	.512	.379	.473									
9. Front and Back roll	.197	.233	.253	.240	.491	.245	.423	.409								
10. Jumping full turns	.286	.270	.360	.359	.472	.305	.488	.462	.498							
11. Johnson Test	.567	.529	.694	.601	.767	.501	.765	.723	.675	.742						
12. Fifty-yard dash	—.318	—.373	—.449	—.460	—.638	—.348	—.605	—.575	—.679	—.594	—.809					
13. Running high jump	.314	.411	.404	.493	.548	.366	.548	.571	.629	.560	.762	—.780				
14. Standing broad jump	.311	.419	.494	.482	.603	.394	.636	.514	.602	.609	.793	—.787	.852			
15. Chinning Strength	.089	.201	.118	.170	.251	.152	.288	.252	.266	.298	.340	—.365	.515	.632		
16. Tumbling Score	—.526	—.484	—.630	—.565	—.751	—.458	—.734	—.699	—.704	—.703	—.966	.844	—.740	—.715	—.314	
Means	9.41	9.14	9.20	9.16	6.25	8.97	6.30	8.57	5.89	4.06	76.90	73.51	45.53	155.73	155.05	111.62
S. D.	1.26	1.59	1.23	1.05	3.63	1.89	3.98	1.44	3.02	3.05	15.05	7.06	5.43	25.02	484.34	52.75

TABLE II

ROTATED FACTOR LOADINGS

	I	II	III	hyp²
1. Straddle Jump	—.008	.122	.680	.477
2. Stagger Skip	.026	.180	.684	.501
3. Stagger Jump	.274	.006	.774	.674
4. Forward Skip	.348	.026	.610	.494
5. Front Roll	.583	.247	.438	.593
6. Jumping Half-turns, right or left	.059	.243	.495	.308
7. Back Roll	.111	.495	.607	.626
8. Jumping Half-turns, right and left	.418	.150	.621	.583
9. Front and Back Roll Combination	.541	.489	.177	.563
10. Jumping Full Turns	.357	.533	.338	.526
11. Total Johnson Score	.481	.487	.714	.978
12. Fifty-yard Dash	.665	.457	.389	.802
13. Running High Jump	.585	.527	.379	.764
14. Standing Broad Jump	.463	.679	.403	.838
15. Chinning Strength	.197	.595	.050	.395
16. Tumbling Score	.562	.424	.653	.922

this factor is commented on below.

Factor II, which is high not only in the track events but also in chinning strength, was identified as strength to handle one's own weight. The items of the Johnson test which are high in this factor are the jumping full-turns and, to a lesser extent, the back roll. This seems to confirm our identification since both of these items require a rather considerable amount of strength.

Factor III is low in the track events and chinning strength, but high in items 1, 2, 3, 4, 7, and 8 of the Johnson test. The first four of these have negligible loadings in Factors I and II, as would be expected from a study of the tests themselves. Their common characteristic seems to be that in each of them an attempt is made to perform an unfamiliar movement pattern as accurately and precisely as possible. If we define "motor educability" as the ability to master a new motor skill quickly, then it would seem that it is the presence of this factor which gives the Johnson test merit as a test of motor educability, which leads us to think that it is possible that in this factor we have isolated motor educability as a separate entity divorced from strength and speed. The high loading of our criterion variable, the number of trials required to *learn* ten *new* tumbling events, in this factor, after the strength and speed elements have been removed by Factors I and II would seem to justify further this identification.

The presence of the high loading for the back roll perhaps requires comment, since, as we have previously noted, this is an exercise depending to a large degree upon strength. Among students who have had no training in tumbling (as was the case with those on whom our data were gathered) the back roll is not nearly as familiar as the front roll, which is commonly learned by most children as a "somersault." Hence,

for many of them the back roll represented an entirely new motor experience—a test of their motor educability. Added to this is the fact that in this test it is not only the ability to complete two back rolls that is needed, but the ability to do each one in a lane two feet wide by seven and one-half feet long. This complicates the test, for many of the subjects who are slow to master new coordinations tend to turn to one side, bringing them outside the confines of the narrow lane, reducing their scores. With these facts in mind, the inclusion of the back roll in this factor seems quite justifiable.

The possibility of further factors which could not be identified from the present variables was investigated. With the three factors it will be noted that the communality (hyp^2) for the Johnson test itself is .978. Theoretically it can be no higher than 1.000. This makes us confident that the three factors we have discussed represent the principal components of the Johnson test, and that further investigation would add little if anything to them.

We may, therefore, conclude that the Johnson test is comprised of three principal elements, which we have tentatively identified as speed of movement, strength to handle one's own weight, and motor educability.

PART II

With these results before us, the second part of the study was begun in an attempt to select a limited number of the Johnson test items which might produce results reasonably comparable to the whole test, but which could be administered in less time. In this undertaking we were rewarded far beyond our expectations.

Selecting the items of the test which were highest in each factor various combinations of these were tried in correlation with the total Johnson score and with the tumbling criterion.

It was recognized that multiple correlation would not offer a final solution to the problem since its use implied the weighting of the various items, which would complicate rather than simplify the administration of the test. However, since it might be necessary to try a large number of combinations, and multiple correlations could be computed from the data in hand more quickly than zero order correlations of sums of the various scores, the first approach was made in this way with the feeling that the results might be considered indicative and would reduce the number of zero order combinations to be computed. The highest of these multiple correlations are presented below:

$R_{11.5,7,8,10}$	.970	$R_{10.8,9,10}$	.880
$R_{11.5,7,8}$	.945	$R_{10.8,8,10}$	.853
$R_{11.7,8,10}$	.920	$R_{11.5,8}$	.858
$R_{11.5,7}$	.918	$R_{11.7,8}$	.860
$R_{11.5,10}$	.870	$R_{11.8,10}$	.857
$R_{10.8,5,8,10}$	.896	$R_{10.12,13,14}$	.854
$R_{10.5,8,10}$	.888	$R_{10.9,12}$	.854
$R_{10.7,8,10}$	.885		

There was no particular reason for computing the correlations involving the track and field items except curiosity, but it is interesting to note the high correlation between the tumbling score and these quite different events.

Since all of the multiple correlations were interestingly high, the majority of them were subjected to the further test of summing the scores made on the items included and correlating the sum with the tumbling criterion variable. These correlations were as follows:

$r_{10(5+7+8+10)}$	.934	$r_{10(5+8+10)}$	.870
$r_{10(5+7+8)}$	.908	$r_{10(5+8+9)}$	.840
$r_{10(5+5+8+10)}$	.890	$r_{10(8+10)}$	.798

The best combination, $5 + 7 + 8 + 10$, correlated .977 with the total Johnson score. This would seem to indicate there is little reason for giving the additional six exercises of the original test, since the correlation is as high as the reliability of .97 reported for the complete test by Johnson.

Wishing to test this conclusion further, data were secured on 155 senior high school girls.* Since the general consensus seems to be that girls are much more variable and much less reliable than boys in any test of physical capacities, we did not expect the correlations to be as high. In this expectation we were justified. Combination $5 + 7 + 8 + 10$ gave a correlation of .862 with the original Johnson score, and combination $5 + 7 + 8$ gave the slightly higher correlation of .868. Since these are higher than the reliabilities of .832 and .844 for the total Johnson test on girls as reported by Barton and Roads respectively, it seemed futile to attempt to raise the correlations by the addition of other test items.

It is interesting to note that the addition of 10 to the combination of $5 + 7 + 8$ lowers the correlation slightly rather than raising it as it does for boys. A study of the original data for girls reveals that almost all of the scores for this test are 0, with only a very few making scores of 2 or 4 out of the possible 10. This test, which consists of jumping from one space to another, making a full turn in the air, landing in the same direction as at the beginning without losing the balance or moving the feet out of the limited area, seems to be too difficult for girls, and the few scores made are mostly made by chance. This same comment is made also by Barton and by Roads.

On the basis of the evidence presented above, it seems reasonable to conclude that much time might be saved and equally valuable re-

* I am indebted to Mrs. Theresa Anderson, North High School, Des Moines, Iowa for the use of these data.

sults obtained by administering only tests 5, 7, 8, and 10 for boys, and 5, 7, and 8 for girls rather than the whole Johnson test.

With the elimination of six of the original Johnson items it becomes possible to simplify the mat used in the performance of the test. It is suggested that a mat might be constructed as shown in Figure 1, with a lane 24″ wide marked down the center of a 15′ mat. This lane is divided into two equal narrow lanes by a center line, and into ten equal parts lengthwise by lines placed each 18″. These lines are alternately ¾″ wide and 3″ wide, the 18″ width being measured to the middle of the line in each case.

On this mat, the rolls are performed in the entire lane, the middle 3″ line being the limit of the first roll. The jumping half-turns are performed on either the right or left half of the lane, the heavy 3″ lines serving as the targets described by Johnson. The full turns are performed in the 18″ x 24″ rectangles, each jump being made to the space beyond a heavy line. For this revised mat, Johnson's original directions would be modified as follows:

5. *Front Roll.*—Perform in entire 24″ lane. Start with feet outside of chart. Perform two front rolls, the first within the limits of the first half of the lane, the second within the limits of the second half, never touching or overreaching the lanes.

Score.—Count five for each roll. Deduct two for overreaching side line right or left for each roll. Deduct one for overreaching end limit on each roll. For failure to perform a true roll, deduct five.

7. *Back Roll.*—Perform in entire 24″ lane. Start with feet outside of chart. Perform two back rolls, one on each half of the lane.

Score.—Score as in 5.

8. *Jumping Half-Turns, Right and Left Alternately.*—Start with feet on first 3″ line. Jump with both feet to second 3″ line, executing a half-turn either right or left. Jump to third 3″ line, executing half-turn in opposite direction. Continue the length of mat, alternating directions of rotation.

Score.—Deduct two for each jump in which the subject does not land with both feet on the 3″ line, or turns the wrong way, or both.

10. *Jumping Full Turns.*—Start with feet outside the chart at about the center of the lane. Jump with feet together to second rectangular space, executing a full turn with the body right or left. Continue across the mat, executing full turns, rotating in the same direction, being sure to land on both feet in every second rectangular space.

Score.—Score as in 8, deducting two if subject fails to land on both feet, oversteps the square, turns too far or not far enough, or loses balance before starting the next jump.

If it is not possible to obtain a canvas with this chart painted on it, the test might be administered by marking the 24″ lane down the center of any 15′ mat, and marking the squares for the jumping exercises on the gymnasium floor with chalk.

PART III

In studying the factorial matrix it was observed that variables 1, 2, 3, and 6, which had high loadings in Factor III, motor educability, had almost negligible loadings in I, speed of movement, and II, strength to handle one's own weight, and that variables 4, 7, and 8 had high loadings in III and much lower loadings in I and II. If we were correct in our identification of III as motor educability, it seemed possible that we might have here the elements of a test of "pure" motor educability, independent of speed and strength—a type of test long hoped for by those in the testing field. This possibility was investigated, and, while the results leave much to be desired, they are presented here in the hope that they may provide a lead which other research workers may find useful.

One of the unique features of the factor analysis theory is that by its use components or factors which cannot be measured in their "pure" form may be isolated and predicted from variables used in the analysis. Thus, it was our plan to predict Factor III, motor educability, which has not yet been measured as a separate entity, from other measurable variables containing it. This may be done by the usual multiple correlation technique, since the factor loading of each variable represents its zero order correlation with the factor. Regression equations may be computed, using a mean of 50 and a standard deviation of 10 for the factor, which will predict the factor on a T-score scale. Such multiple correlations were computed as follows:

$R_{III \cdot 3,2,1,6,4}$	.88
$R_{III \cdot 3,2,1,6}$	.88
$R_{III \cdot 3,2,6}$	.86
$R_{III \cdot 3,2,1}$	.84
$R_{III \cdot 3,2}$	.84
$R_{III \cdot 6,2}$	.75

Thus, it is possible by the use of the four exercises, straddle jump, stagger skip, stagger jump, and jumping half turns, to predict Factor III, motor educability, with a reliability of .88.

To test our theory that these exercises were not dependent upon strength or speed, multiple correlations were computed of variables 3, 2, 1, and 6 with 15 (chinning strength) and with 12 (fifty-yard dash) as follows:

$R_{15 \cdot 3,2,1,6}$	.23
$R_{12 \cdot 3,2,1,6}$	.55

These correlations would indicate that we have been fairly successful in eliminating strength, but that the fifty-yard dash still has something in common with these tests. This was to be expected in view of the fact that variable 12 (fifty-yard dash) has a loading of .389 for Factor III in our factorial matrix. We may therefore interpret our $R_{12 \cdot 3,2,1,6} = .55$ as meaning either that scores in the fifty-yard dash de-

pend to a certain extent upon motor educability, or that the performance of the four exercises depends to a certain degree upon speed.

A multiple regression equation was computed to predict Factor III from variables 1, 2, 3, and 6.

$$X_{III} = 3.008\ X_3 + 2.264\ X_2 + 1.870\ X_1 + 1.000\ X_6 - 24.85$$

This was simplified to:

$$X_{III} = 3\ X_3 + 2\ X_2 + 2\ X_1 + X_6 - 25$$

which predicts Factor III on a T-score scale with a mean of 50 and a standard deviation of 10.

However, one serious difficulty stands in the way of using this simple combination of exercises to predict motor educability. Because these four exercises are so very simple, the subjects make consistently high scores on them, so that out of a possible score of ten on each exercise, the means for the four exercises are 9.20, 9.14, 9.41 and 8.97 respectively. This makes it impossible to attain a score for the factor itself which is even one standard deviation above the mean, and a subject making a perfect score on each exercise would have a T-score in the factor of only 55. Below the mean, of course, this difficulty is not encountered.

For this reason, the test as here proposed has little practical value, since it would not differentiate to any useful degree those students ranking above the mean. However, it is presented with the feeling that it is significant because of the suggestions it provides for further investigation in the field of a "pure" motor educability test. It seems to indicate that if we wish to devise a test of motor educability independent of other factors, we may be more successful if we turn our backs on the tumbling and stunt types of tests and concentrate on simple and complicated movement patterns of the type devised by Johnson.

SUMMARY

Part I. The items of the Johnson mat test, supplemented by scores on the fifty-yard dash, the running high jump, the standing broad jump, chinning strength, and the number of trials necessary to learn ten tumbling stunts, were analyzed by the Thurstone technique of multiple factors. Three factors were isolated, which were identified as: speed of movement or muscle viscosity, strength to handle one's own weight, and motor educability.

Part II. Various combinations of the test items which ranked high in each of the factors were correlated with the total Johnson test score and with the tumbling criterion, both by multiple correlation and by zero-order correlation after summing the scores. The best combination was found to be tests $5 + 7 + 8 + 10$, which gave a correlation of .977 with the total Johnson score. The correlation of this combination

with the tumbling criterion was .934, only slightly lower than the correlation of .966 obtained with the total Johnson test.

For girls, the combination of 5 + 7 + 8 gave a correlation of .868, which was lowered to .862 by the addition of 10. In view of the much lower reliability of the test for girls, this correlation was considered satisfactory.

It was suggested that combinations of Johnson's exercises of 5 (front roll), 7 (back roll), 8 (jumping half-turns), and 10 (jumping full turns) for boys, and of 5, 7, and 8 for girls, might well be used instead of the whole Johnson test, and that the results of these combinations would be of as much value in the measurement of motor educability and for sectioning classes as would the original Johnson test, and would greatly reduce the amount of time required for the administration of the test.

A simplified mat was presented which could be easily constructed in any gymnasium so that lack of equipment need not keep any instructor from using the test.

Part III. The possibility of devising a test of "pure" motor educability was investigated, and a combination of 3 (stagger jump) + 2 (stagger skip) + 2 (straddle jump) + (jumping half-turns) — 25 was found to predict "pure" motor educability (Factor III) with a multiple correlation of .88. This combination was not recommended for use because the extreme simplicity of the exercises makes the distribution of scores so top-heavy that the results fail to differentiate subjects scoring above the mean. It was felt, however, that the test might be significant in providing a new lead for research in the field of "pure" motor educability.

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Tests for Predicting Potential Ability in Gymnastics and Tumbling

By Eugene Wettstone, M.A.

Gymnastics Instructor, Pennsylvania State College
State College, Pennsylvania

THE need for constructing prognostic tests is as important in the field of physical education as it is in other fields of education. This is especially true in athletics where a number of attempts have been made to formulate objective predictive tests, with only a few favorable results.[3,7,9] * Track and field, and basketball studies have produced fairly successful tests, and the tests are reliable.

Available literature on the testing of athletic abilities presents no studies on the essential native capacities of gymnasts, or on tests that will measure such qualities. Consequently, gymnastic coaches must still resort to the subjective visual observation method, a method which is limited and uncertain and which should be supplemented by accurate mechanical determinations.

When a gymnastic coach assembles his prospective candidates at the beginning of a season, the first question confronting him is: which of these men possesses the qualities, both innate and acquired, that go to make a good gymnast? Coaches often spend too much time on individuals that do not possess the essential innate capacities and miss finding many students who do have the prerequisites. Reliable prognostic tests would help the coach in advising students who are interested in some phase of athletics and would assist in locating men who are potentially good but who have never been motivated to take part in gymnastics and tumbling.

In an institution such as the West Point Military Academy the type of prognostic tests we have in mind would not be needed because there all plebes are required to take a full semester of gymnastics and pass a very comprehensive apparatus test. Since time is not a limiting factor in this case, a semester of diversified gymnastics will take the place of prognostic tests and reveal reasonably well the potentially outstanding men and the gymnastic qualities which they possess.

However, in a college or university where gymnastics is not compulsory, where time is limited, and, especially, where the enrollment is large, prognostic tests will be of extreme value to the coaches and students.

* Indices refer to Bibliography at end of article.

In dealing with this problem of determining potential gymnastic ability, the writer has three definite objectives in mind: (1) to compile a complete list of the innate and the acquired qualities that a good all-around gymnast should possess; (2) to devise tests that will measure the degree and amount of such qualities in any individual; and (3) to set up a working formula that can be used as a measuring rod.

These tests should function primarily in locating the "raw material" for developing good gymnastic teams and for motivating purposes.

PRELIMINARY PROCEDURE

The first step in the preliminary procedure for compiling working tests was to set up a list of the most apparent qualities which most good gymnasts possess. The result was a list of twenty-five requisites obtained from the various suggestions received from a group of coaches interested in gymnastics at the University of Iowa.

The second step in the survey was to draw up a form letter listing the previously determined requisites and asking for additional points and criticisms. This letter was then sent to coaches of the Western Conference and the Eastern Intercollegiate Gymnastic League. The same letter was submitted to outstanding gymnasts, including United States Olympic stars, to those holding intercollegiate titles, and to authorities in the field of tests and measurements in physical education.

From the splendid replies received in the survey, a final list was made of the thirty-four capacities usually possessed by a good gymnast. Using the same method, the writer has listed, roughly and in order of their importance, the qualities that the tests are intended to measure.

The qualities were scored according to their importance. Three checks were given to the most important qualities, two checks were awarded to the next most important qualities, and one given to those not very important. Those considered of no importance were not rated. Table I shows the final combined score of all the ratings submitted as requisite for a good, all-around gymnast.

SUBJECTS STUDIED

In ascertaining the validity and reliability of tests for potential gymnastic ability, twenty-two subjects from the University of Iowa were used. The group included Western Conference all-round and individual champions, members of the varsity gym team which won the Western Conference championship in 1937, and inexperienced freshmen. All men in this group of twenty-two were in shape and actively interested in gymnastics at the time of testing, but they differed in ability and ranking.

It is unfortunate that there were not more gymnasts for testing. Experienced and once outstanding men in the field were available, but they were not used because they were no longer active and in a practiced condition. The logical results that we were able to obtain reduces the charges against the small number of subjects tested, however.

Time and equipment did not permit the testing of all the qualities listed, neither were there tests available to test all of the qualities; consequently, tests were devised for the fifteen qualities considered most important. The fifteen qualities receiving the highest number of votes were the ones selected for testing. Every subject studied was given the same test under virtually the same conditions, and his score was tabulated.

TABLE 1

Apparatus	Tumbling	Qualities Required
62	42	Interest and determination
55	37	Physical courage (guts)
55	41	Good coordination
50	27	Strength—pull-ups, push-ups, thigh and leg flexion
47	32	Kinesthetic sense
45	23	Aggressiveness and self-reliance
43	32	Strong heart
42	31	Quickness and precision
41	14	Abdominal strength
41	23	Flexibility
40	22	Timing
39	19	Proper maturity
38	29	Feeling of where one is in the air
38	23	Educability
36	28	Sensory rhythms (intervals and spacing)
33	18	Proper weight (between 125 and 170 lbs.)
33	32	Semicircular canal function
32	13	Light legs, narrow hips
31	23	Motor rhythm
31	19	Understanding of mechanics of skills
31	21	Sense of beat as in music
36	28	Balance
28	15	Experience, training, and practice in allied fields
24	18	Ability to visualize in three dimensional spaces
19	10	Ability to press or push objects equivalent to body weight above the head
*7	0	Normal heart
*3	2	Tenacity
*3	0	Propulsive power
*3	0	"Money-player" (one who rises to the occasion)
*3	0	Ability to emphasize the difficult phase of the exercise
*3	0	Showmanship
*2	2	Physical and mental sensitivity
*2	0	Not predominantly one-sided
*1	1	Proper center of gravity

* Additional qualities submitted in answers to the original questionnaire.

The methods of classification used in this survey were as follows:

After all subjects were carefully observed for seven months, subjective ratings were procured from the coaches of the gymnastic teams (freshman and varsity). The coaches rated men according to their respective potentialities, taking into account their interest, determination, timing, and coordination. Men who showed potentialities indicating that they might be Conference material were given 13 points; those who might be good varsity men were given 11 points; fair varsity, 9 points; poor varsity, 7 points; non varsity, 5 points. Some men were ranked between these classes.

TECHNIQUE IN TESTS AND MEASUREMENTS

There are many tests that have been found fairly reliable as objective measures of physical qualities. A group of these tests has been selected with the object in mind of determining how well the tests function in testing gymnastic qualities. A number of new tests were introduced in this problem. It was necessary to consider for these tests and measurements the following things:

The amount, proportion and degree of interest and determination, physical courage, coordination, strength, kinesthetic sense, condition of the heart, quickness and precision of movements, flexibility, timing, maturity, motor rhythms, motor educability, and sensory rhythms.

Interest and Determination.—As a supplementary aid in ranking freshmen who were inexperienced, we submitted a questionnaire which gave an indication of their interest and determination and, at the same time, added to the data used.

Physical Courage.—A new test was used for the testing of courage.[12] The test, which is relatively unknown, involves a Smedley-Grip Dynamometer and a stop watch. The procedure was as follows:

The subject was asked to grip as hard as possible with either hand. The highest grip out of three trials was taken. The stable pointer of the dynamometer was then set at two-thirds of this score, and the individual was asked to grip the apparatus again with his best hand, squeeze it until the variable pointer coincided with the stable pointer, and hold it there as long as possible. The time in seconds which elapsed between the beginning of the grip and the point at which the individual could no longer hold the grip at that point was recorded for his score.

Coordination, Quickness, and Precision of Movements.—"The Burpee Test is primarily one of agility and of big-muscle coordination.[11] The test, which is relatively unknown, is given as follows; upon the word of command, the pupil bends forward, bending his knees as far as desired, and places his hands on the floor. He then thrusts his legs backward to the front leaning rest position. He then returns to the first position and rises to the position of attention. He does this movement

as many times as possible during a period of ten seconds. The results are counted in full movements and quarters of movements. Thus, if the stopping signal is given with the pupil in the front leaning rest position, this counts as adding two-quarters of a movement to the number already completed." The subject's original score was then multiplied by four to eliminate fractions.

Strength.—It is a known fact that a gymnast requires great strength in the upper part of his body. The legs are depended upon only in such phases of gymnastics as tumbling and the long horse, but even in these events, the essential movements are of the upper part of the body and of the trunk. With this in mind we used a modified strength test which consisted of: (1) number of pull-ups, (2) number of dips, and (3) number of leg lifts.

In the leg lift exercises used to measure abdominal strength, the subject hung from stall bars and flexed the leg and thigh to a horizontal position as many times as possible. The final strength score was the result of these three scores added together.

Kinesthetic Sense and Semi-Circular Canal Function.—Though the test used to measure this ability is relatively unknown and has not appeared in physical education literature, it is a simple one. It consists of three parts; the first deals with the relationship of one part of the body to another; the second deals with the relationship of one part of the body to an object nearby; and the third deals with the relationship of the gross movements of the body to positions in the air. The third part consisted of inverted hangs on the rings.

Part one consisted of finger pointing and positions of the arms. With the index fingers pointing straight forward and with the wrists slightly flexed, the subject was asked to swing the arms from an outward horizontal position forward and inward in an attempt to make the two index fingers meet over the head, then to the left side, the right side, and behind the back. Five points were given if the subject made his index fingers meet, four, three, two and one, respectively, for attempts that decreased in closeness.

Along with finger pointing in this first part, we had a test for holding the arms in certain positions relative to the body. These were: arms sideward horizontally, arms upward vertically, and upper arms forward horizontally with forearm upward vertically. All of the finger pointing and arm exercises were done with the eyes closed.

Part two consisted of target pointing. Two targets were necessary for this test, one on the wall at the height of four feet, the other on an overhead board six to seven feet high. The subject was asked to stand at arm's length from the target for a fraction of a second, then, with eyes covered, point at the bull's eye of the target. The same

procedure was followed turning the head to the left and flexing the head to the chest in pointing to the overhead target. The scores ranged from one to ten.

Part three consisted of gross positions of the body on the flying rings. The first position required that the thighs be in a horizontal position. The second position required that the body be swung forward and upward until it became vertical between the rings, with the legs and thighs extending horizontally backward, thus assuming a right-angle position. These positions were also assumed with the eyes closed. The scores ranged from one to five for each position, according to the ability to assume the correct position.

To obtain the final kinesthetic sense score, the above mentioned three scores were totalled.

Condition of the Heart.—The writer did not administer a test for a normal heart, since the subjects studied had all received medical examinations which reported the heart normal before the time of testing.

Flexibility.—In testing for the degree of flexibility, three measurements were taken. The first tested the flexibility of the shoulder girdle. The individual stood with his back against the wall, arms in horizontal position, with the palms of the hands facing front. The subject moved forward slightly, still maintaining contact with the wall and the tips of his fingers, until he reached the point at which he could move no farther and still maintain contact with the wall. His degree of flexibility was then quickly measured with a tape which extended from a point on the spine at the level of the shoulder blades to the wall directly behind. This measurement was then corrected for span.

The second tested the forward trunk flexion. In this flexibility test the individual sat on the floor with legs outstretched and feet about 12 inches apart. As the individual flexed his body forward as far as possible, the distance from the top of his sternum to a perpendicular spot on the floor between his legs was measured. The test was corrected for height.

The third tested the flexibility of the back. The individual assumed a prone position on the floor, with arms sideward horizontal (swan position). As he slowly extended his back, raising his chest from the floor, the distance from the bottom of his sternum to the floor perpendicularly below was measured when the individual had reached his maximum extention; this measurement was corrected for height.

This formula was used for determining the final flexibility score:

$$\frac{\text{Shoulder flex.}}{\text{Span}} - \frac{\text{Abdominal flex.}}{\text{Height}} + \frac{\text{Back ext.}}{\text{Height}} = \text{Flexibility Score}$$

Timing and Sensory Rhythms.—A sense of timing and beat is very essential for gymnastic success because most of the movements and apparatus combinations are of the rhythmic type. A man may have coordination of bodily movement, yet be inefficient as a gymnast because he lacks the timing and the sensory feeling of the movement; for example, combinations on the flying rings.

The Seashore test for musical talent has also been used in measurements of physical education talents, and has been found fairly reliable.[13] Two records were used in this study, one the record which measures the sense of rhythm (records 6A and 6B), the other which measures the sense of timing (records 3A and 3B). Scoring of the test was the same as that suggested by Seashore.

Motor Rhythm.—A new apparatus for testing motor rhythm was a revision of the Robert Seashore motor rhythm unit by H. M. Williams, who added a pattern disc to the Seashore test in 1933.[14]

In the Williams test the subject was required to follow rhythmic patterns by tapping a key in unison with the pattern set up by the apparatus. There were four different patterns which varied in difficulty. Perfect tapping scores were recorded on a counter scoring apparatus set up by Williams. The total scores of all four patterns were taken for the final motor rhythm scores. It is obvious that a certain sense of motor rhythm is necessary for gymnastic success, but the only rhythm test available at this institution at present which is adequate and reliable is that of Seashore.

The writer does not recommend this test for general use because it is not practicable. The large amount of complex equipment and the time spent is too great compared to its contribution.

More Educability.—According to Johnson[6] it has been found, "It is native skill and not the student's present level of achievement which determines the rate at which he can advance in a sport such as gymnastics." With this in mind, two tests were administered, one the Johnson, the other, the Hill test.[4]

The Johnson test consisted of ten combinations to be done on a canvas marked with squares and lines of various sizes. The ten movements are foreign to any sort of natural ability, thus avoiding the possibility of the subject's having practiced similar activities. According to the author, this test has a reliability coefficient of .97 and a validity coefficient of .69.

The Hill test was also administrated as a measure of motor educability. Twelve stunts are included in this test, two of which were taken from Brace's educability test, tests number two and number nineteen. The other ten stunts were devised by Mr. Hill.

Anthropometrical Measurements.—The following items were used for this section of the study:

1. Weight.
2. Height.
3. Span.
4. Length of humerus (acromian to radiole).
5. Length of radius (radiole to stylion).
6. Circumference of the chest (xiphoid level).
7. Circumference of the upper arm.
8. Circumference of the forearm.
9. Circumference of the thigh.
10. Circumference of the calf.
11. Grip measurement (endurance).

The techniques in taking the above measurements were identical with those proposed by Hrdlicka.[5]

ANALYSIS OF DATA

Zero order correlations were computed between each variable and the criterion score of gymnastic rating. Those variables that showed fair correlations are listed in Table II. Intercorrelations were computed for those variables which showed a correlation with the criterion score of any respectable size with the twenty-two subjects. Those correlations are also listed in Table II:

TABLE II

INTERCORRELATIONS (22 CASES)

		o	8	P	S	H	3	9	B
Thigh									
Height	(8)	−.71						.60	
Strength	(P)	.47	−.43						
Seashore	(S)	.34	−.15	.24					
Hill	(H)	.39	−.23	.08	.15				
Chest									
Height	(3)	−.53	.79						
Calf									
Height	(9)	−.54							
Span									
Height	(1)	−.36	.39						
Burpee	(B)	.51	−.39	.02	.21	.40			
$\sqrt[3]{\frac{Wt.}{Ht.}}$	(W)	−.60	.81				.84	.36	.36
Thigh									
Chest	(4)	−.56	.60						
Mean		9.8	39.3	49.6	14.0	19.8	48.2	20.5	24.1
S.D.		1.8	2.3	14.4	11.0	2.3	2.5	2.0	2.4

Partial correlations were computed as shown in Table III.

TABLE III

PARTIAL CORRELATIONS

$r_{04.8}$	—.237	$r_{OH.B}$	.234
$r_{08.4}$	—.561	$r_{OW.1}$	.539
$r_{03.W}$	—.057	$r_{01.W}$	—.197
$r_{OW.3}$	—.337	$r_{OW.8}$	—.060
$r_{OB.H}$	—.399	$r_{08.W}$	—.365

On the basis of these partial correlations

$$\frac{3\sqrt{\text{Weight}}}{\text{Height}}, \frac{\text{Span}}{\text{Height}}, \frac{\text{Chest}}{\text{Height}}, \frac{\text{Thigh}}{\text{Chest}}, \frac{\text{Calf}}{\text{Height}}$$

were eliminated from further computations.

Using the remaining variables, $\frac{\text{thigh}}{\text{height}}$, Burpee, Strength, Hill, Seashore, multiple correlations were computed as shown in Table IV.

TABLE IV

$R_{O.8BPHS}$	— .828	$R_{O.8BH}$	— .769
$R_{O.8BPH}$	— .807	$R_{O.8B}$	— .755
$R_{O.8BP}$	— .794		

Since the difference between $R_{O.8BPHS}$ and $R_{O.8BP}$, or between $R_{O.8BPH}$ and $R_{O.8BP}$ is so slight, it is felt that the addition of *H* and *S* does not raise the correlation sufficiently to warrant the extra time of administration. A partial for $R_{OH.9BP}$ gave —.091, which justified the omitting of *H*.

However, prediction equations are presented for all four combinations in Table V.

TABLE V

X_0 ..... Gymnastic ranking

X_1 ..... $\frac{\text{Thigh Circumference}}{\text{Height}}$

X_2 ..... Burpee Test Score

X_3 ..... Strength Score

X_4 ..... Hill Test Score

X_5 ..... Seashore Test Score

$R_{O.12}$

$X_0 = -.472X_1 + .209X_2 + 19.163$

$R_{O.124}$

$X_0 = -.463X_1 + .153X_2 + .130X_4 + 17.578$

$R_{O.123}$

$X_0 = -.355X_1 + .59X_2 + .035X_3 + 13.990$

$R_{O.1234}$

$X_0 = -.355X_1 + .172X_2 + .034X_3 + .113X_4 + 13.866$

$R_{O.12345}$

$X_0 = -.359X_1 + .158X_2 + .026X_3 + ..163X_4 + .053X_5 + 6.327$

Test ^{R}0.123 seems to be the best, for it is easily administered and is reliable. (See Appendix following the bibliography, page 126 and 127).

SUMMARY

1. A list of qualities which it was thought a good gymnast would possess was compiled and sent to twenty-five of the country's outstanding coaches and gymnasts. These authorities ranked the qualities according to importance.

2. Tests for fifteen of the highest ranking qualities were obtained.

3. A selected group of twenty-two gymnasts actively engaged in gymnastics at the University of Iowa acted as subjects. The group included Western Conference all-round and individual champions, members of the varsity gym squad which last year won the Western Conference championships, and inexperienced freshmen.

4. Ten tests for the highest ranking qualities were administered and eleven anthropometrical measurements were taken.

5. From these data a test was constructed consisting of three elements, $\frac{\text{Thigh circumference}}{\text{Height}}$, strength test (consisting of chinning, dipping, and thigh flexion), and the Burpee test, which predicted potential ability in gymnastics with a multiple correlation of .79 by means of the regression equation:

$$X_0 = -.355X_1 + .260X_2 + .035X_3 + 13.990$$

A regression equation for ^{R}0.12 which had a multiple correlation of .75 was also computed.

$$X_0 = -.472X_1 + .209X_2 + 19.163$$

TABLE VI

X_0 (GYMNASTIC RATING TABLE)

National collegiate material	13 points and above
All Conference material	13 points
Good varsity material	11 points
Fair varsity material	9 points
Poor varsity material	7 points
Not quite varsity material	5 points

CONTRIBUTION OF THE STUDY

An objective test for the measuring of potential gymnastic ability has been presented which does not require the use of expensive apparatus and which is easily administered.

It is believed that this test should not be used to cut down a squad, segregating good from poor, but that it should be used to encourage people to come out for gymnastics and tumbling, who have "what it takes" to be good. There are many boys who would like to win their

letter in some sport, but lack the weight or speed which is so greatly required in sports such as football, basketball, baseball, track and the like.

Many boys can be encouraged to try gymnastics, especially if their scores in the predictive test run high.

It should also be remembered that a test with a multiple correlation of .79 is not a perfect test, and relatively low test scores should not be used to discourage any person who is interested. The test is primarily a finding device.

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COMPUTATION TABLE FOR $R_{0.128}$

$$.3551 \frac{\text{thigh}}{\text{height}} - .2590 \text{ Burpee} - 10.0000$$

Burpee Score	Thigh/Height Scores															
	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
17	5.52	5.17	4.81	4.46	4.10	3.75	3.29	3.03	2.68	2.32	1.97	1.61	1.26	.90	.55	.19
18	5.78	5.42	5.07	4.71	4.36	4.00	3.65	3.29	2.94	2.58	2.23	1.87	1.52	1.16	.81	.45
19	6.04	5.68	5.33	4.97	4.62	4.26	3.91	3.55	3.20	2.84	2.49	2.13	1.78	1.42	1.07	.71
20	6.30	5.94	5.59	5.23	4.88	4.52	4.17	3.81	3.46	3.10	2.73	2.59	2.04	1.68	1.33	.97
21	6.56	6.20	5.58	5.49	5.14	4.78	4.43	4.07	3.72	3.36	3.01	2.65	2.30	1.94	1.59	1.23
22	6.82	6.66	6.11	5.75	5.40	5.04	4.68	4.33	3.97	3.62	3.26	2.91	2.55	2.20	1.84	1.49
23	7.07	6.72	6.36	6.01	5.65	5.30	4.94	4.59	4.23	3.68	3.52	3.17	2.81	2.46	2.10	1.75
24	7.33	6.98	6.62	6.27	5.91	5.56	5.22	4.85	4.49	4.14	3.78	3.43	3.07	2.72	2.36	2.01
25	7.59	7.24	6.88	6.52	6.17	5.82	5.46	5.11	4.75	4.40	4.04	3.69	3.33	2.95	2.62	2.27
26	7.85	7.50	7.14	6.79	6.43	6.08	5.72	5.37	5.01	4.66	4.30	3.95	3.59	3.24	2.88	2.63
27	8.11	7.76	7.40	7.05	6.69	6.34	5.58	5.62	5.27	4.91	4.56	4.20	3.85	3.49	3.14	2.78
28	8.37	8.01	7.66	7.30	6.95	6.59	6.24	5.88	5.53	5.17	4.82	4.76	4.11	3.75	3.40	3.04
29	8.63	8.27	7.92	7.56	7.21	6.85	6.50	6.14	5.79	5.43	5.08	4.72	4.37	4.01	3.66	3.30
30	8.89	8.53	8.18	7.82	7.47	7.11	6.76	6.40	6.05	5.69	5.34	4.98	4.63	4.27	3.72	3.56
31	9.15	8.79	8.44	8.08	7.73	7.37	7.02	6.66	6.51	5.95	5.60	5.24	4.89	4.53	4.18	3.82
32	9.41	9.05	8.70	8.34	7.99	7.63	7.27	6.92	6.56	6.21	5.85	5.50	5.14	4.79	4.43	4.08
33	9.66	9.31	8.95	8.60	8.24	7.89	7.53	7.18	6.82	6.47	6.11	5.70	5.41	5.05	4.69	4.54
34	9.92	9.57	9.21	8.86	8.51	8.15	7.79	7.44	7.08	6.73	6.37	6.02	5.66	5.31	4.95	4.60
35	10.18	9.83	9.47	9.12	8.76	8.41	8.05	7.70	7.34	6.99	7.34	6.28	5.92	5.57	5.21	4.86
36	10.44	10.09	9.73	9.39	9.02	8.67	8.31	7.96	7.60	7.25	6.89	6.54	6.18	5.83	5.47	5.12

COMPUTATION TABLE FOR $R_{0.125}$

.0354 Strength — 3.9902

Strength Score	Strength Score	Strength Score
15 = 4.52	44 = 5.54	73 = 6.57
16 = 4.55	45 = 5.58	74 = 6.60
17 = 4.59	46 = 5.61	75 = 6.64
18 = 4.62	47 = 5.65	76 = 6.68
19 = 4.66	48 = 5.68	77 = 6.71
20 = 4.69	49 = 5.72	78 = 6.75
21 = 4.72	50 = 5.76	79 = 6.78
22 = 4.76	51 = 5.79	80 = 6.82
23 = 4.80	52 = 5.83	81 = 6.85
24 = 4.83	53 = 5.85	82 = 6.89
25 = 4.87	54 = 5.90	83 = 6.92
26 = 4.91	55 = 5.93	84 = 6.96
27 = 4.94	56 = 5.97	85 = 6.99
28 = 4.98	57 = 6.00	86 = 7.03
29 = 5.02	58 = 6.04	87 = 7.07
30 = 5.06	59 = 6.07	88 = 7.10
31 = 5.08	60 = 6.11	89 = 7.14
32 = 5.12	61 = 6.14	90 = 7.17
33 = 5.15	62 = 6.18	91 = 7.21
34 = 5.19	63 = 6.22	92 = 7.24
35 = 5.22	64 = 6.25	93 = 7.28
36 = 5.26	65 = 6.29	94 = 7.31
37 = 5.30	66 = 6.32	95 = 7.35
38 = 5.33	67 = 6.36	96 = 7.38
39 = 5.37	68 = 6.39	97 = 7.42
40 = 5.40	69 = 6.43	98 = 7.45
41 = 5.43	70 = 6.46	99 = 7.49
42 = 5.47	71 = 6.50	100 = 7.53
43 = 5.51	72 = 6.53	101 = 7.57

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Compiled by G. B. AFFLECK
Springfield College, Springfield, Massachusetts

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BOOK REVIEWS

MENTAL HEALTH THROUGH EDUCATION. W. Carson Ryan. (New York: The Commonwealth Fund, 1938). $1.50.

Dr. Ryan traveled widely visiting schools and clinics of various kinds in an effort to learn what is taking place in the field of education in respect to mental hygiene. His year of study was made possible by the Commonwealth Fund of New York.

His book, *Mental Health Through Education,* seeks to answer the question: How does educational practice today, at every level and for every type of education, square with what is known of mental hygiene, and what further advances can be made?

The author draws from a great many sources to illustrate his points and to prove that educational practice in many respects does *not* square at all with what is known today of mental hygiene. There are serious discrepancies between good mental health and what actually goes on in the schools. For the most part, Ryan found that the work of the leaders has not reached far down into the everyday activities of the schools, and education is not doing what it should for mental health.

"On the other hand," Dr. Ryan says, "there is much to record on the credit side."

He feels that there is good evidence that a much sounder mental health program is possible for the individual and for society. The possibilities for mental health in the everyday work of the schools are emphasized, and the desirable effect that a teacher with a healthy personality can have in creating a healthy school atmosphere.

One of the big influencing factors found was in the attitude of the administration. Here Ryan found his greatest cause for complaint. He discovered that administrative conditions in American schools in general are hardly conducive to mental health. The program and methods also come in for their share of criticism.

The book gives some attention to the special agencies that have proved of value in recent years—school psychiatric staff, child guidance clinics, visiting teacher service, institutes for child development—and various agencies in the community that are concerned with the "happiness and well-being" of children.

While Dr. Ryan is rather critical, his criticisms are of a constructive nature. He suggests certain steps that might be taken to speed up the process of mental health through education. His suggestions are: a refacing of the educational task; creating a better emotional atmosphere for schools; a different kind of teacher preparation; provision of an enriched and flexible school curriculum; humanizing administration; closer rapprochement of the faculty and schools; and finally, active collaboration by the schools with the community.

As a whole, the book is very readable and extremely well written.

LOUISE SLEEMAN

Instructor in Physical Education for Girls, Senior High School, Elkins, West Virginia

FUNDAMENTAL HANDBALL. Bernath E. Phillips. (New York: A. S. Barnes and Co., 1938) 124 pages, illustrated, $1.50.

Any individual, whether a novice or possessed of considerable handball experience, should find the study of *Fundamental Handball* by Bernath E. Phillips well worth the time and effort. Although the introduction and history of the game as presented are merely

complimentary to the real effort of the author, many interesting points concerning the origin, progress, and present status of the game are included.

The author has put together what appears to be the best information on the game available. A lack of good printed material on handball has been one of its biggest handicaps. My own experience has been that handball is played differently and that its speaking terms vary greatly in different localities.

It must be said that it suffers greatly from lack of students. Out of my own fifteen years of experience, I know of few players who have made any attempt to develop the game from the standpoint of fundamentals. Therein lies the real value of this author's work. He lists clearly the most accepted terminology, rules, and regulations. He makes well-analyzed presentations of the various shots, augmenting his descriptions with clear pictures and charts which should assist the beginner in developing his game scientifically, and the more accomplished player to recognize more readily the reasons for the failures of his own game. To the instructor it offers a "piecemeal," organized presentation of the game.

JOHN L. BLAIR
Instructor in Physical Education, Livingston Junior High School, Albany, New York

PRINCIPLES OF PHYSICAL EDUCATION. Jesse Fiering Williams, M.D., (3rd. ed.; Philadelphia: W. B. Saunders Company, 1938) 450 pages, $3.00.

First published in 1928 and first revised in 1932, the second revision of *Principles of Physical Education* by Dr. J. F. Williams continues to be the most outstanding book on physical education ever published. Physical educators the country over are unanimous in agreement that it is "the book" in physical education.

This new edition has been entirely reset and has been brought up to date with many significant changes and additions. The underlying philosophy has not, however, been altered in any way and the purpose and aims of the book are precisely what they were when it was first published in 1928.

In reviewing this book, it seems necessary to repeat the four specific aims which Dr. Williams sets up. They are: "First, the development of the organic systems of the individual through physical activities, so as to give vitality, health, strength, and power; second, the development of the neuromuscular system, particularly in relation to its control over certain fundamental skills; third, the development of favorable attitudes toward play; fourth, the development of standards of conduct by instilling standards of fair play."

The third chapter on "The Nature of Man" has been rewritten and expanded into three chapters covering man's biological foundations, his psychological foundations, and his sociological foundations. This expanded and thorough treatment of the nature of man, with its emphasis on the Thorndike psychology is excellently done and should aid in developing in the student of physical education a thought-provoking attitude toward man and his development through the ages as it affects his mental, moral, social, and physical life.

The other chapters are still basically the same but have been improved by the addition of new materials and fundamental principles.

HARRY L. SAMUEL
Associate Professor of Physical Education, School of Physical Education and Athletics, West Virginia University

FOLK DANCES OF GERMANY. Elizabeth Burchenal. (New York: G. Schirmer, Inc.) 113 pages, $2.00. On title page, "Twenty-nine dances and singing games, provided with full directions for performance."

It was this reviewer's privilege to have been a member of the group before whom Miss Burchenal, on her return from Germany, first showed her motion pictures and described informally her researches into the folk dance of certain regions of that country—the islands of

Rügen, Fehmarn, and Föhr and the regions of Schleswig-Holstein, Mecklenberg, and Pomerania on the north coast; Luneberger Heide, Westphalia, Hesse, the Palatinate, Schaumburg Lippe and the Black Forest in the west; Silesia in the East; and upper Bavaria in the center. The charm of the book does not, therefore, come as a surprise, but as a fulfilled example of what an enlightened textbook in recreation and physical education can be.

Miss Burchenal's studies were carried on with the support of fellowship grants from the Oberlaender Trust and the Carl Schurz Memorial Foundation, an organization whose object is the furthering of cultural relations between America and the German-speaking peoples. Through the personnel of these organizations she was brought into intimate association with German families and communities where she could observe and participate in daily and seasonal rites and folk dance celebrations. Also in all her studies, she was cordially assisted by many eminent specialists in German folkways and folk art.

The reviewer can scarcely do better than quote from the Foreword of the book, written by Professor Otto Lehman, former president of the International Commission on Folk Arts: "The author, Elizabeth Burchenal, through extensive travel over the course of two years, has gained an intimate acquaintance with the German countryside and has come into spiritual communion with the people themselves. She has not only taken part in the festivals of the people, but has broken bread with many a family of peasant folk, and exchanged thoughts and ideas with them. This book, therefore, is not only a record of her researches in folk dancing, but also an expression of what she has experienced in folk life, and the degree to which she has entered into the inner spirit of the German folk dance. The result of serious studies in German folk art, this book will no doubt be a contribution toward increased understanding and esteem for that which is essentially German."

After all, the real values of participating in the folk arts of other countries are not to be transmitted to our growing generation by mechanical directions only, though these naturally must be and are provided in this book, with clarity and thoroughness. They lie rather in achieving sympathy and understanding of the moods, modes, and behaviors of our "good neighbors" of other lands. "When the captains and the kings depart" (and are forgotten) the essence of a national culture will be found in the surviving record of the thought and action of humble folk and in the surviving examples of the fine arts. Miss Burchenal has done a valuable service in preserving and interpreting for us a type of folk art which is peculiarly prone to disappear from the records of history.

Of course, as Miss Burchenal points out, the deeper implications, corollaries, and values can hardly be set forth in an elementary text. On this aspect of her studies, and on her discoveries in the derivations of folk dance in America from European forms, she promises a later publication.

The book is in folio format and is beautifully illustrated with photographs of dancers in native costume from quarter-page to full-page size.

EUGENE C. HOWE
Wellesley College

NEW DIRECTIONS OF PHYSICAL EDUCATION FOR THE ADOLESCENT GIRL IN HIGH SCHOOL AND COLLEGE: a Guide for Teachers in Cooperative Curriculum Revision. Rosalind Cassidy, Ed. D. (New York: A. S. Barnes and Co., 1938) 231 pages, $2.50.

The long title of this book is honest and exact. The book is one that no one teaching physical education will want to miss. The fundamental educational concepts here presented are worthy of serious consideration by every teacher at every school level.

There are two good theses on which the "new directions" are based. The major one is that the organismic approach be regarded as essential in teach-

ing at any school level. The wholeness and uniqueness of the individual, and the unity of individual and environment, are discussed here at some length, and on the whole very well. The second thesis, that there is now in America a new era of creative expression, is also of vital significance to us. The idea of creative expression in dance has long been familiar to us. The idea that the whole physical education program be considered for its contribution to creative expression is perhaps less familiar, but possibly even more important.

The implications of these viewpoints have been followed to a logical conclusion in the guidance program proposed for students in physical education. Dr. Cassidy is obviously acquainted with the work being done in progressive education. Her readers will probably be either skeptical or enthusiastic about her conclusions. It is to be recommended strongly that the skeptical read the book two or three times at intervals of a month or so, to clarify their own perspective regarding the implications involved.

One of the finest contributions of this book is the suggestion that teachers and major students form study groups to consider the newer educational theories and the physical education problems involved. There is an excellent extensive bibliography of twenty-five pages giving study sources on present-day America and the adolescent, on curriculum planning, on diagnosis and adjustment, on health and physical education, and other related fields. On page 160 is a very helpful list of studies of adolescents in progress at the present time. Teachers who would understand and follow these suggestions regarding new directions, whether or not they would follow them to Dr. Cassidy's conclusion, must themselves study, in order to avoid a superficial consent without an underlying comprehension. Otherwise, the same things can happen to these ideas that happened in some cases to the "project method" and "panel discussion" concepts in the hands of those who gave them lip service because they were new and acceptable, but failed to grasp their real import and intent.

The book, then, deals with *ideas*—and with good ones. There is more to be said about these ideas, as Dr. Cassidy herself has pointed out. But that it must be said in the directions indicated in this book is surely true. That is, if we are to remain a democracy it is surely true. It is interesting to contemplate that at the present turn of the world's affairs, these directions may not hold if "it happens here." Perhaps the contribution of the physical education profession to a democratic way of life may be inestimable if quite widely throughout the United States the philosophy of physical education here proposed be translated into teaching method.

LOUISE S. COBB
Associate Supervisor of Physical Education, University of California

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